

In This Issue—The Tractor In Texas

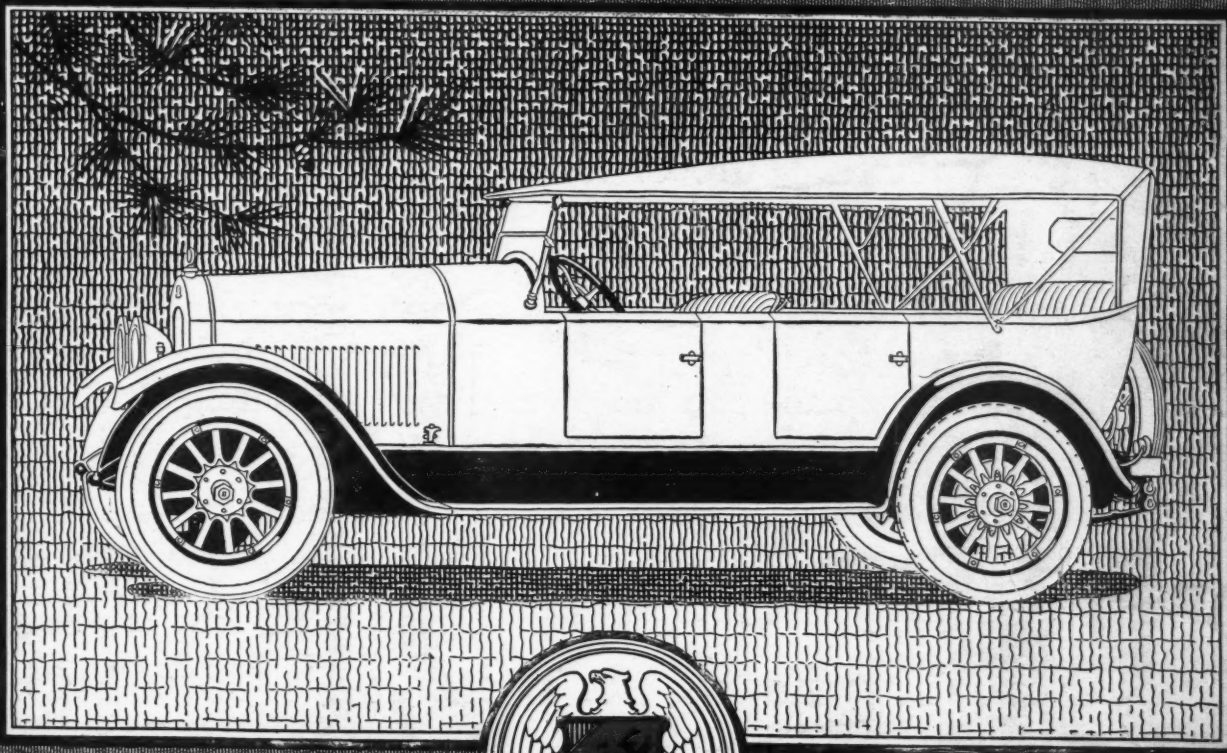
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MOTOR AGE

Volume XXXVII
Number 16

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CHICAGO, APRIL 15, 1920

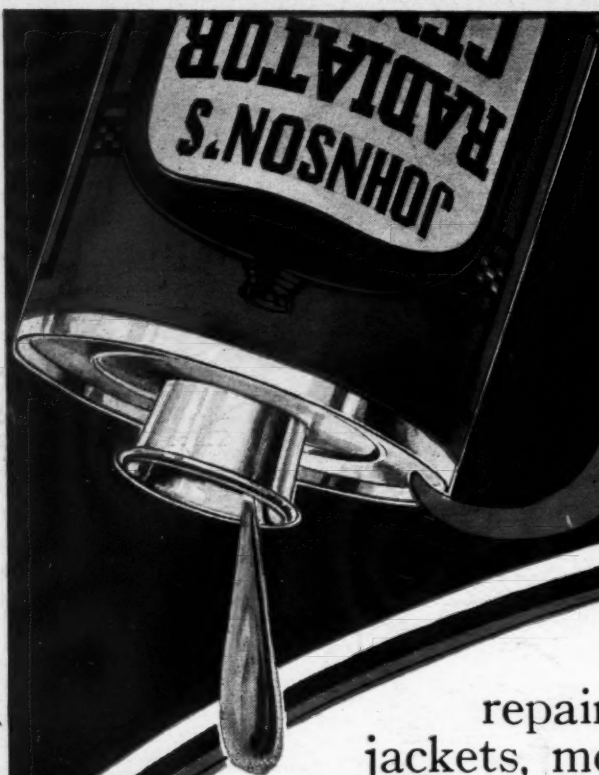
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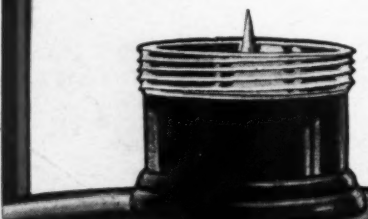
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MOTOR AGE

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HEL-FI SPARK PLUGS fire every ounce of gas, hold against compression—lean down your mixture and help your motor to utilize the maximum of her efficiency on every turn of her crankshaft.

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THIS AND THE NEXT

"Funny title," you'll say. But anyway we mean to tell you briefly what special articles you're going to find in this and next week's number of MOTOR AGE.

Perhaps there are few states in our country in which there are as wonderful possibilities for power farming as Texas. At any rate the Lone Star state is now and will be a large user of power farming equipment. Dealers in Texas will be interested in what a MOTOR AGE investigator has learned about Texas in connection with an extensive survey he has been making of tractor and motor conditions throughout the southwest and Pacific coast. Dealers in other states might do well to also read the article "The Tractor in Texas," by Fred M. Loomis.

Making Mechanics

The need for trained men in the automotive industry, especially in the mechanical end of service, is becoming so great that in one instance the public schools are being looked to for help. This is a problem that is getting harder to solve every day. We've learned of one school that added a course for motor car mechanics and if you'll turn to pages 10 and 11 you'll learn more about it.

Wear Proof Engine

This isn't the name of any particular engine as far as we know, but some of our foremost engineers insist that we'll have them before long. Some claim it will be possible to float crankshafts and camshafts on a thick oil film which will eliminate any metal-to-metal contacts in the parts that ordinarily wear. Here's food for thought and something worth while looking into. Pages 20 and 21 tell all about it so be sure to read them.

The Tea Wagon Again

Not long ago one of the thinkers in our think

shop got up a story about a service tea wagon. Some of you will remember this tea wagon consisted of a portable stand or bench which could be used in connection with repair jobs. The idea was to have something that was movable and handy and which would carry the necessary tools instead of having them scattered around the floor. Well now, someone has come along with another adaptation of the tea wagon but on a larger scale. This one is used by a manufacturer who is efficiently assembling engines by use of this portable bench. No doubt this adaptation of the tea wagon has some good pointers for the service department, so look for this story.

Coming—Next Week

Shall We Divorce the Shop? The rapid growth of the automotive industry means that the time is coming when we must get more out of our present building and shop layouts. There must be more intensive methods. Perhaps the time will come when exclusive service stations or shops will take care of all the repairs of our automotive equipment. Still, many hold that every dealer who sells cars, trucks, or tractors ought to have his own service station and shop. Anyway it will be discussed pro and con in MOTOR AGE next week.

Service Managers Who Have Made Good

There are a lot of service managers who have made good at their present jobs and we believe many of our readers would be interested in knowing why they made good. There always is some good reasons why a man makes good in any job and his methods if passed on to others may help. In next week's issue we are starting a feature section about service men. Each week one man and his methods will be described.

**NEWS-STAND BUYERS OF MOTOR AGE
SEE ANNOUNCEMENT ON PAGES 146-147**

Stewart

MOTOR TRUCKS



Owners' Satisfaction Proved—

1. *By use in 38 foreign lands*
2. *By fleets that grew from one*

The international use of Stewarts is no less impressive than the growth of multiple Stewart fleets at home.

Abroad, Stewarts are giving daily and profitable service to owners in 38 foreign countries.

At home, the unique quality of Stewart service has caused the growth in hundreds of cases from the original one Stewart (write for names) to large fleets.

But it isn't the size of a fleet that tells the real story. A big firm may decide to motorize its hauling—may buy 20 to 50 trucks at once. It's the experience of a concern that started with one Stewart, found it a business-winner, bought more Stewarts one after another to keep pace with expansion, which is a real guide.

Here is a letter from an owner. This owner-satisfaction with Stewart performance has made the Stewart Motor Corporation a world leader in truck building in only seven years.

**MACON TRANSFER CO.
MACON, GA.**

After running our first truck a short while we purchased a 1½ ton truck and four months later we purchased a second one ton.

After all three of these trucks had given us splendid service for six or eight months we decided to purchase our fourth, a ¾ ton Stewart, four months ago, which makes our fleet number four trucks at the present date.

All four of these trucks are giving absolute satisfaction and we will further state that the first one ton which we purchased is running as good and doing as much work as it did the day we drove it out of your place.

If business increases in the next month as much as it has in the past we will be obliged to add another Stewart to our fleet, which will make five of these trucks.

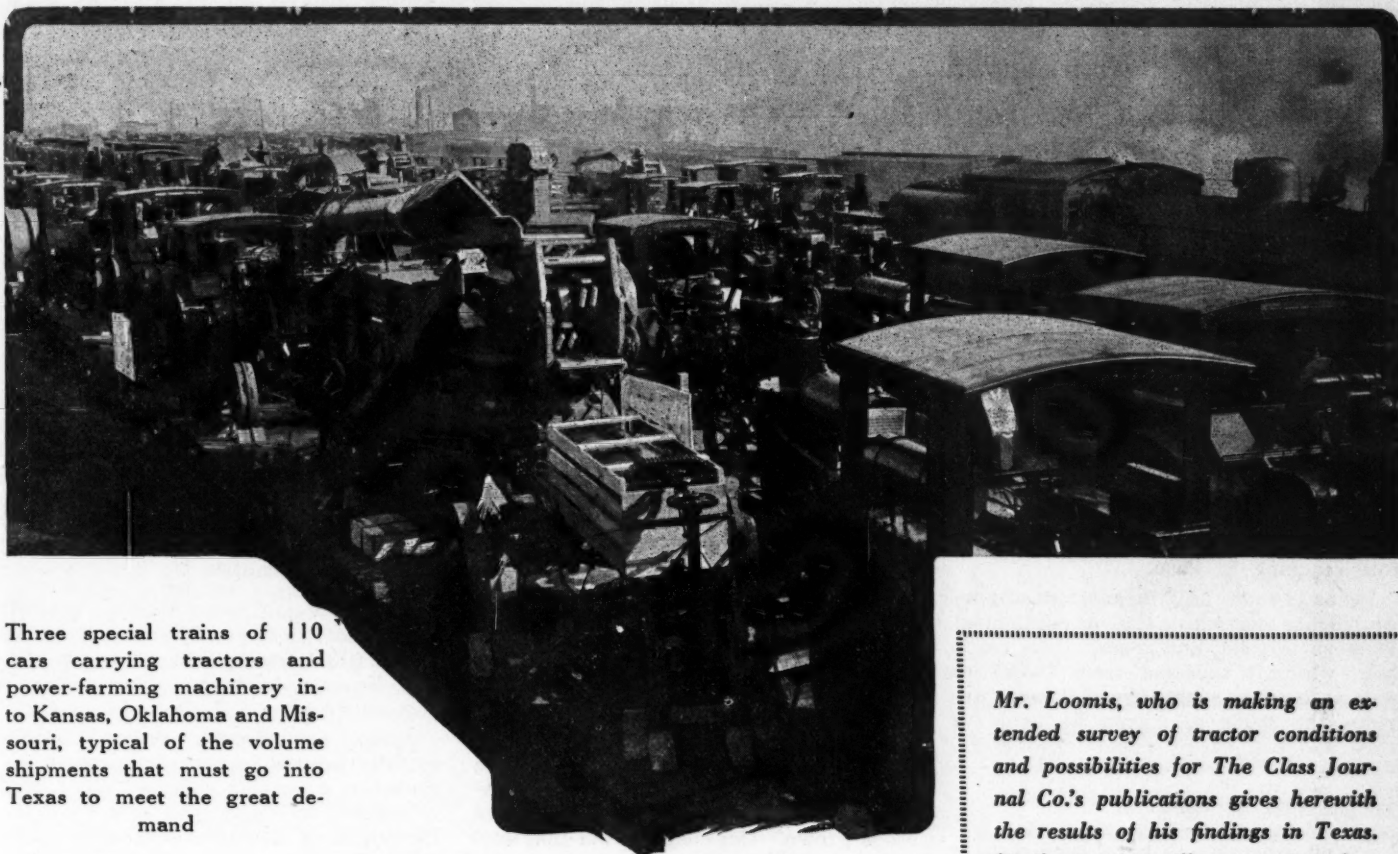
(Signed) WALTER S. HERIN

Chassis prices f. o. b. Buffalo: ¾-ton \$1350; 2000-lb. \$1655;
1½-ton \$2250; 2-ton \$2875; 2½-ton \$3095; 3½-ton \$3895

STEWART MOTOR CORPORATION, BUFFALO, N. Y.

The Stewart truck has won—by costing less to run

MOTOR AGE



Three special trains of 110 cars carrying tractors and power-farming machinery into Kansas, Oklahoma and Missouri, typical of the volume shipments that must go into Texas to meet the great demand

Mr. Loomis, who is making an extended survey of tractor conditions and possibilities for The Class Journal Co.'s publications gives herewith the results of his findings in Texas. Similar stories will appear in subsequent issues dealing with tractor subjects related to Pacific Coast region and other sections

THOUSANDS OF TRACTORS FOR TEXAS

Potential Demand Enormous—New Type of Dealer Promises to Depose Interests Now in Control

BY FRED M. LOOMIS

FROM the haunts of Rude Boreas in the vicinity of Minneapolis to the land of perpetual spring, where one is in the caress of the gulf breezes, is some wonderful trip. Such has been my good fortune within the last month.

On that trip one goes through the dominions of several of the agricultural monarchs. From the realm of King Spring Wheat to that of King Corn is but a step. Next comes the land where King Winter Wheat reigns supreme, to be followed by the home of King Cotton.

En route one crosses principalities under the control of King Petroleum, where oil derricks stand so close a corn stalk can hardly stand between.

In Oklahoma and northern Texas there is a strip which these sovereigns seem to hold in common. Wheat, corn, cotton and oil alternate or stand cheek by jowl until one hardly knows to whom he owes allegiance.

But, no matter where one goes one finds the tractor.

The tractor is getting to be the national bird of the American farmer.

The tractor is a national issue. Hardly have I seen an inch of ground between Minneapolis and El Paso where the tractor is not either an actuality or a potentiality. Of course, there's some country in the 600-mile stretch between San Antonio and El Paso where a tractor would be much out of place, but I passed through that section in the night and did not see it.

Most of us have a more or less clear conception of what the tractor means to the Northwest, the Central West and the near Southwest. But I am convinced that very few have any sort of appreciation of what the tractor is going to mean to Texas. No matter if thousands of them already have been sold down

What Mr. Loomis Has to Say Regarding Tractor Possibilities in Texas

"I am convinced that very few of us have any sort of appreciation of what the tractor is going to mean to Texas. No matter if thousands of them already have been sold down there, the potential demand is so enormous that these thousands hardly have made a splash"

"Here is a land that easily might absorb every tractor that is being turned out in this country, provided every such tractor was adapted to the conditions existing here"

"Corn and cotton—think what that means. Row crops, miles and miles of them through the black belt. The ground is plowed in the Spring for both corn and cotton. Very similar machines are used for planting both products. The period and manner of cultivation is almost the same for both, they separate only at harvest time. It means a tremendous demand for the general purpose tractor and for the motor cultivator, both will have a tremendous sale here"

here, the potential demand is so enormous that these thousands hardly have made a splash.

It is trite to speak of the Lone Star State as an empire. The map tells us that. But one cannot realize its immensity until after one has traveled over it. The writer came more than 1000 miles after entering the state at Denison before reaching El Paso.

Texas is south only by accident of geographical location. It's pure Central Western in spirit and aspect. The black belt, which I followed from Dallas to San Antonio, is suggestive of Iowa. Replace the fields of cotton by fields of corn and one hardly could tell the difference.

Texans Live Wires

And wherever I have been I have marveled at the pep and push displayed by the business men whom I have met. There is none of that indolence conventionally attributed to the South. Upon the contrary, Texas seems peopled with live wires, and you will find one just as often behind the soft Texan dialect as you will behind the broad A of the North. About the only difference discernible is that there is more suavity and courtesy here and more brusqueness there.

Perhaps Texans take on these characteristics as an attribute of climate. Texas has about as many varieties of climate as any similarly sized area on the face of the earth.

This is because of varying altitude. From sea level under an almost tropical sun to 5000 or 6000 feet under a Central Western sky, gives variety enough to satisfy even the most capricious critic of climatic conditions. And this probably accounts also for the fact that while Texas ranks as one of the principal cotton growing states of the Union, she also holds fourth place as a corn growing state and at the same time maintains a very respectable reputation as a producer of wheat and oats. Incident-

ally, all this enhances her potentialities as a market for tractors.

On the 100-mile trip between Dallas and Waco I saw more tractors at work in the fields than I ever saw in a trip of like length anywhere else in the United States and I have done some considerable traveling. But it seemed to me that where I saw one tractor I should have seen hundreds, because if ever Nature made a country adapted for tractors she certainly did it when she made the black belt of Texas.

Roughly Texas may be divided into three distinct parts. The Eastern portion in sections is more or less rugged and sandy and much of it is not well adapted for the use of tractors, both because of the topography of the country and because of the character of the crops grown. One dealer from that section, whom I met in Dallas, said a mis-

guided individual called upon him recently and tried to interest him in tractors. The dealer finally ended the matter by offering to pay the salesman \$1,000 for every tractor he succeeded in selling, providing he in turn would pay \$5.00 to the dealer for every farmer upon whom he called who could not use a tractor. Negotiations ended abruptly.

In Favored Localities

That does not mean that no tractors will be sold in Eastern Texas. Far from that. Hundreds will be sold, but they will be sold in favored localities, not generally.

Again the western portion of the state is mountainous or arid and is distinctively a grazing country. Much of it will never feel the tickle of a plow nor the touch of a tractor except in these isolated areas where irrigation is pos-



The universal type of tractor is making a strong bid in Texas, owing to the vast amount of row crop cultivation. This shows a Moline Universal doing night work on a Texas ranch

sible. Much of the Panhandle, however, is good tractor territory, as witness the business done at such places as Amarillo.

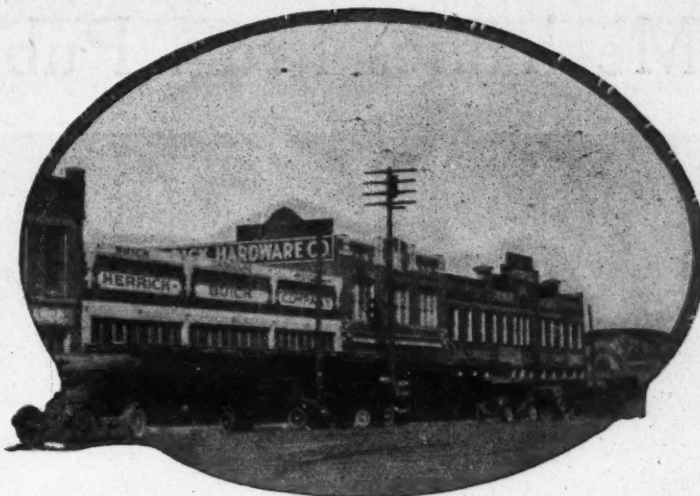
But as I rode down that wonderful breadth of black land which covers all of Central Texas I could not help but think that here was a land which easily might absorb every tractor which at present is being turned out in this country, provided every such machine was adapted to such conditions as exist here. The possibilities seemed as limitless as the horizon and I believe they are.

An old time implement man once said that Texas could promise to take more goods and then fall down on the proposition harder than any other part of the country. That may have been the fact once upon a time, but it is no longer so. Texas is keeping her promise these days and she is taking the goods.

Branch house managers of implement concerns at Dallas talk glibly of a business which, during the last few years, has increased from a few hundred thousands to as many millions a year. In turn, not a motor car dealer in the state can begin to get as many cars as he wants, and any old thing on wheels which has a gas engine in it will sell at a top price. The motor truck dealers are in the same boat and cannot come anywhere near meeting the demand.

The Herrick Hardware Co.

As an instance of the way Texas is absorbing farm equipment this year, take the business of the Herrick Hardware Co. at Waco. Herrick's business is a combination of wholesale and retail. He sells hardware, agricultural implements, tractors, automobile accessories and motor cars. His sales in his implement department alone have aggregated



The various salesrooms of the Herrick Hardware Co. and the Herrick-Buick Co. take up almost a whole block of Waco's public square

greater than \$30,000 per week for the last two months. That is indicative of how Texas is absorbing farm operative equipment. Incidentally it may be mentioned that the Herrick company sold more than 100 tractors during 1919.

The case of the Herrick company is typical. The implement dealer has a half-Nelson on the present day tractor trade of Texas. He is without question the most important factor, eliminating the Fordson organization from present consideration. Big concerns like the Herrick company are numerous and most of them sell large numbers of tractors. While perhaps 25 per cent of these concerns sell motor cars, as does Herrick, still they consider themselves to be primarily implement men and rely upon their implement trade for their volume business.

This can be accounted for in a way by the fact that most of the better known tractors are represented in Texas by branch houses which always have looked to the retail implement dealer as the only possible outlet for their goods. Some of these concerns have been established here for as many as fifty years.

They have an established policy of dealer representation based upon the retail implement dealer. One veteran branch house manager at Dallas told me frankly that he never sought the trade of a motor car dealer on his tractor and power equipment line, and that if one such came to him seeking a tractor agency he promptly turned him down because he did not consider him either eligible or desirable as a tractor dealer. The fact is that, outside the Fordson organization, the Texas motor car dealer never has had a chance to show what he could do with tractors.

There are indications, however, that things are about to change in this respect.

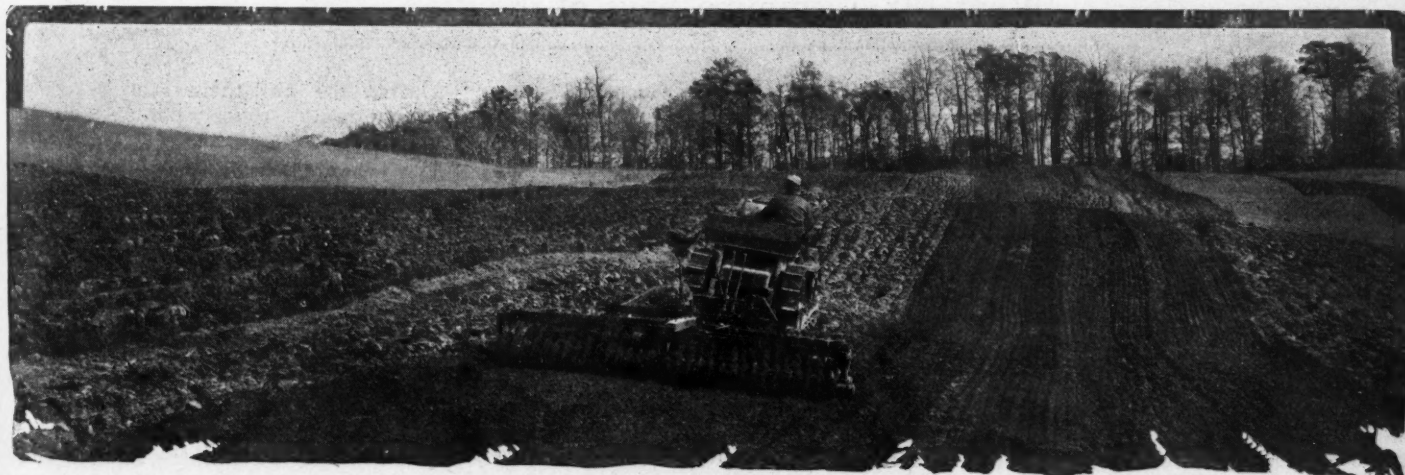
New tractor concerns are coming into the trade at such points as Ft. Worth, Dallas, Houston, San Antonio, Amarillo, El Paso and other distributing centers, who have a different conception of dealer capability.

Favor Power Equipment Dealer

These concerns are not making any special effort to put the motor car dealer, as such, into the tractor business, but they are developing the new exclusive power equipment dealer. Where the motor car dealer gets in on this is that these concerns are looking largely and preferably to the ranks of motor car dealers for the material which they hope to train into the kind of exclusive dealer they want.

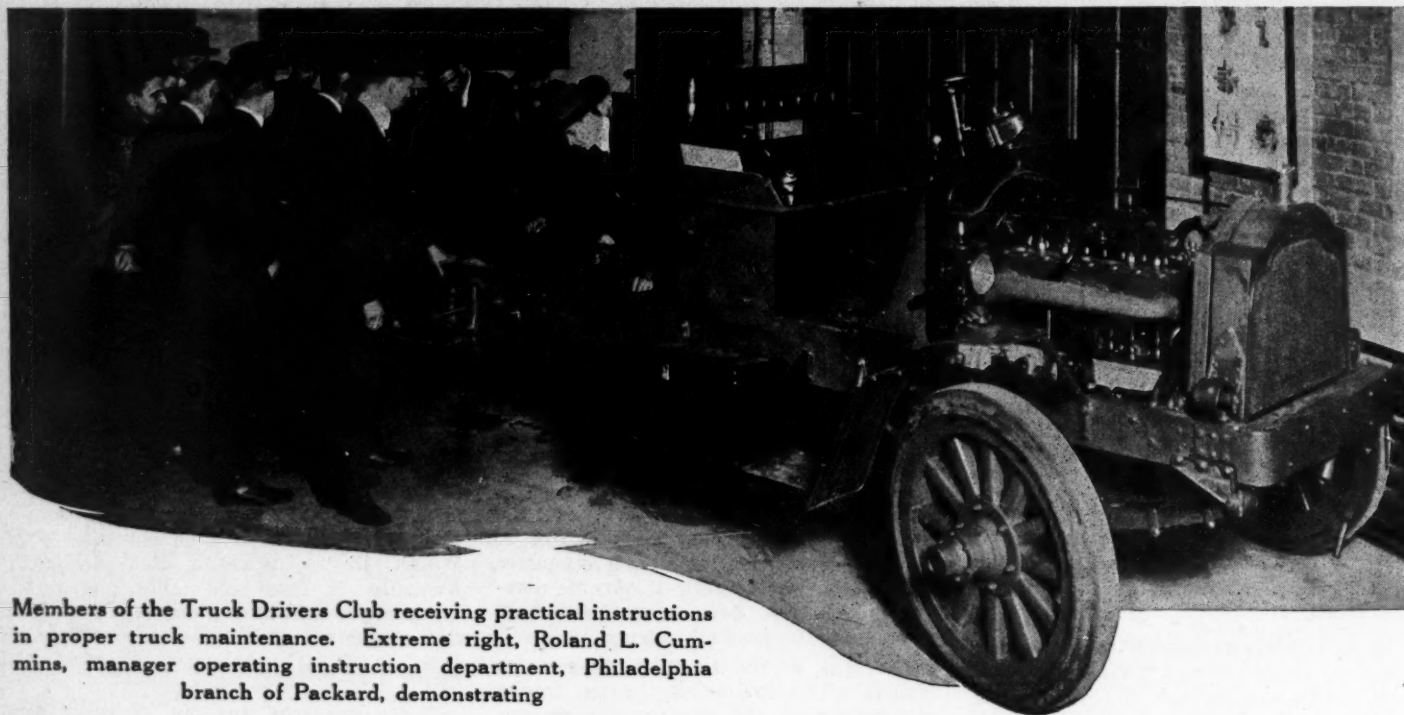
In selling policy, in service policy and in all other ways these new concerns are following methods which are diametrically opposed to the policy of the old line companies. True, most of them are young yet, hardly one having been in business for more than two years and it is hardly fair to say how they will succeed. But after fifty years, if it takes

(Continued on page 32)



In some of the sparsely settled country of Texas the tractor often is working miles away from the nearest dealer, whose service must be such that there will be little danger of the tractor being out of commission at critical times

Recruiting Mechanics From Public Schools



Members of the Truck Drivers Club receiving practical instructions in proper truck maintenance. Extreme right, Roland L. Cummins, manager operating instruction department, Philadelphia branch of Packard, demonstrating

Course in Mechanical Training for Automotive Industry Has Been Inaugurated in Frankfort High School, Philadelphia

THE MOTOR TRUCK ASSOCIATION of Philadelphia and the Philadelphia Automobile Trade association believe there is a possibility in recruiting from the public schools for the mechanical end of the automotive industry. Through their aid, that of Professor Ash, in charge of vocational training in the Philadelphia schools and that of several of the more important automobile and motor truck concerns, a course in mechanical training for the automobile and truck trade has been inaugurated in the Frankfort High School of Philadelphia and it is probable that the

course will also be extended to other high schools.

Walter Y. Anthony, general manager of the Packard Motor Car Co. of Philadelphia, was made chairman of the committee of the Motor Truck association which made arrangements and Roland L. Cummins, assistant transportation engineer and manager of the operating instruction department of the Packard company obtained two highly trained and experienced instructors for the high school course. Many concerns in the trade are supplying parts for the course and the Packard company donated a chassis.

What Mr. Cummins Says of the Plan

THE importance of the automobile industry to the prosperity of the country and of the automobile and motor truck to the daily needs of the American public can hardly be estimated. There is practically no business in the United States that is not to-day affected more or less by the automobile or motor truck.

This can be clearly understood upon consulting the records of the industry when we find that there are over 7,000,000 vehicles now in operation in the United States. The automobile industry at the present time represents a capital of over \$1,500,000,000 and the number of people engaged in the industry would be sufficient to populate the city of Philadelphia.

The automobile industry is now the third largest industry in the United States and is growing by leaps and bounds. In the last five years alone, the production has increased tremendously. The Anticipation Report for the production of passenger cars by the automobile concerns of the country for 1919 is about 1,125,000 cars and about 230,000 motor trucks.

Trained Men Becoming Scarce

At the rate that this industry is growing, it becomes evident that very shortly the available supply of trained and experienced men will become exhausted and that unless steps are taken to educate others to step into the positions which will have to be filled, this very essential industry will be crippled.

During the war there was no other business in the country which was so hard hit as the automobile business. It was called upon to assume greater burdens than ever before, with the result that when those in charge attempted to lay down their plans for expanding, in order to bear this increased burden, which had been suddenly thrust upon them, the problem of sufficient trained man-power became the vital question; and when work was started on the many large war orders, it was found that before any progress could be made in the turning out of the materials requested by the government, training schools had to be established in each and every one of these large factories and valuable time was lost, not mentioning the large amount of money that was spent in

training inexperienced people to do the work.

This same condition will soon be upon us again, not from any such crisis as the great war, but from the natural evolution of the business; and it is our firm belief that unless some national movement is incorporated, whereby young men may be trained to enter this great industry by others than the automobile manufacturers, the entire business of the country may be more or less affected through the inability of the automobile industry to keep up the pace to supply the demand for cars and trucks to meet the transportation problems of the country.

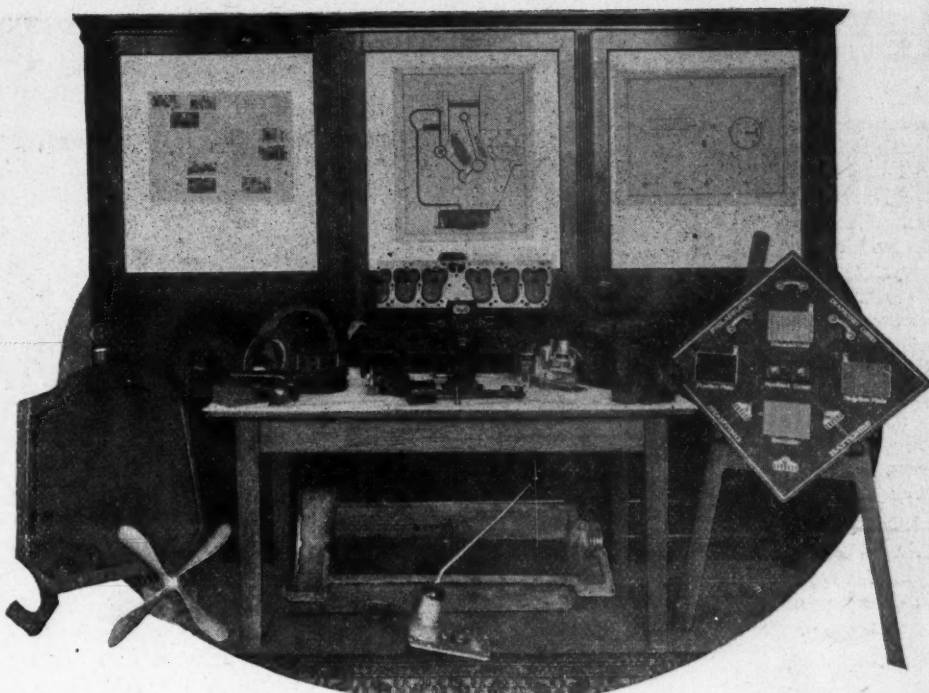
In the State of Pennsylvania last year, there were over 365,000 passenger cars and 31,000 motor trucks, as well as 27,000 motorcycles registered.

There are also, according to the latest records available, over 12,000 business concerns in the United States directly engaged in the automobile business, such as dealers in the new cars and trucks, garages and repairshops, and so forth, all of which shows a wonderful field for an enterprising young man starting his business career.

Present System Costly

If the automobile industry must continue to educate and train the men it requires to carry on its business, it means thousands upon thousands of dollars each year must be added to the overhead cost of operation for the time lost in carrying on this work, as well as it being necessary for them to oftentimes carry a much larger force of men in repairshops and other departments, than is absolutely necessary to do the work; simply because each individual man has not had the previous training that would make him capable of more than he is at present doing.

This tremendous money loss has to be made up somewhere and naturally must



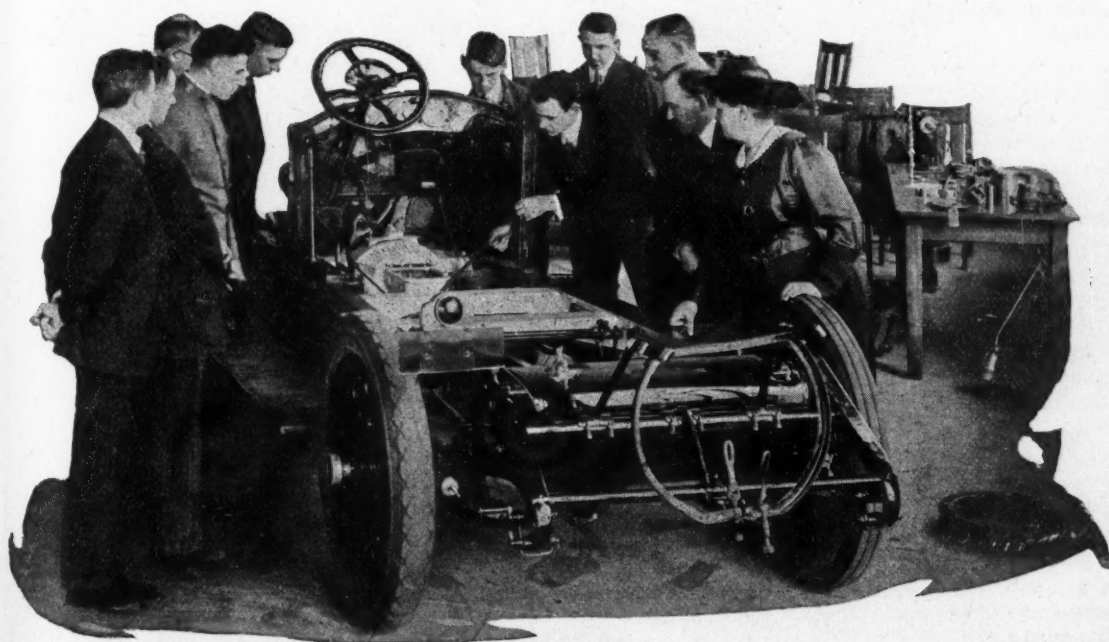
Corner of the clubroom used by the Truck Drivers Club of the Packard Motor Car Co. of Philadelphia. Parts used in demonstrations at lectures are specially prepared, showing cross-sectional views

"At the rate this industry is growing, it becomes evident that very shortly the available supply of trained and experienced men will become exhausted. . . . It is our firm belief that, unless some national movement is incorporated whereby young men may be trained to enter this great industry, by others than the automobile manufacturers, the entire business of the country may be more or less affected"

be added to the cost of production, with the result that the final price of a car or truck, or of repair work, or service rendered after the same is put into operation, must bear its share of the loss and, in turn, the general public and the thousands of other manufacturing concerns must bear their part.

Realizing all these things, it becomes very evident that if a course of training that would fit a young man to enter the automobile industry were incorporated in the public schools, such action would be greatly appreciated and very enthusiastically greeted by the automobile business men.

It is quite probable that a course could be inaugurated that would teach those of the young men who are scholars in the high schools the theory of the gasoline engine, with sufficient instruction in the carburetion and general construction of the engine and various other principal parts of the vehicles by lecture and practical laboratory work, with a reasonable amount of instruction on the elementary principles of electricity sufficient to acquaint them with the ignition and lighting systems now in use by automobile manufacturers. Such a course could be limited to cover but a short space of time and still be of great assistance in the training of men to be repairmen, operators, etc.



Packard passenger car owners and chauffeurs receive a thorough course in Packard car operations and care by special appointment



Salesroom and office of the Riefling Automobile Co.

Made Good by Being on the Job

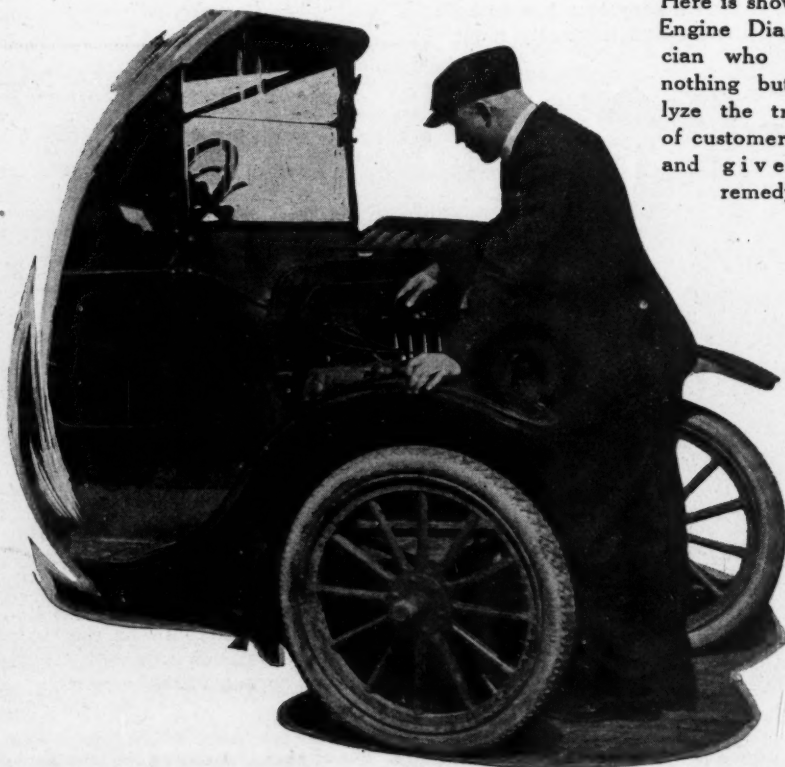
Whether Customer Wants a Bolt Or Engine, Piece of Wire or Body,
He Is Given Instant Attention at the Riefling Automobile
Co., St. Louis

IN the last 3 years the Riefling Automobile Co. of St. Louis rose from a small Ford agency to the largest in the city, with a capitalization of \$75,000. This success is due to the seven reasons shown on the next page, according to Frank J. Riefling, the president.

Attention to these factors, Mr. Riefling says, were the direct causes for the advances made by his concern with the idea of giving service first. The customer is always considered to be right at the Riefling plant and this accounts for the unusual growth in patronage.

Service to the customer, the first in the list of causes for success, means, according to the Riefling theory, immediate response to the demands. Whether the desire is for a bolt or an engine, a piece of wiring or a new body, the customer is given instant service regardless of the time or expense necessary in delivery. While there may result an occasional tangible loss in such methods, the long run has proved conclusively that it has exceeding merit, according to the president of the firm.

"The customer who needs a few bolts and who calls us on the phone and then receives prompt response is going to call on us when he desires more important and bulky parts for his car," said Riefling.



Here is shown the Engine Diagnostician who does nothing but analyze the troubles of customers' cars and gives the remedy

ling. "There is nothing unusual in this method but I am almost sure that very few garage and repair men comply with the requisites of such business demands."

The "engine diagnostician" is another element of value in securing efficient and minimized cost in repair work. He is an expert mechanic who can find the engine trouble with accuracy and great rapidity. His duties are merely discovering the fault and giving advice as to the repair. Besides this he does nothing and in this method of specialization much time which ordinarily might be wasted by an inexperienced diagnostician is conserved. The time saved is money taken off the bill rendered to the customer at the end of the month and the result is that the next time repairs are needed, Riefeling gets the business.

Repair Stalls a Feature

The separation of the working men in the repair shop from the garage portion of the building is another feature which is known as a real time-saver. Ordinarily garage men repair their cars right in the garage, thus giving opportunity for the distraction of the attention of the repairers from their work by the least occurrence at the doors or inside the building. When time is paid for by the hour these occasional disturbances are found to be costly by the customers and so they are omitted entirely by this efficient contrivance.

Exclusive use of the most modern tools

Seven Reasons Why the Riefeling Automobile Co. Is Making Good

1. Service to the customer without avoidable delay or hitch, accessories being delivered immediately after the order is received by telephone or through the mails;

2. The employment of an "engine diagnostician" whose sole duty in the repair shop is the determining of the trouble in the engine and advising necessary repairs or alterations;

3. The repair stalls are separated from the garage proper by partitions which prevent the interference which might be offered by customers and visitors;

4. The use of hand tools improperly and for other purposes than originally intended is strictly prohibited, the monkey-wrench and the pliers are not used but are substituted for by the socket wrenches;

5. Latest inventions in repair shop machinery have been installed, doing away with the conventional jack and the trouble of removing engines from the bodies;

6. Employees are treated with every degree of fairness and facilities for their comfort are paid particular attention;

7. An unusually large supply of accessories and engine and body parts are always on hand, thus abolishing unnecessary waiting and delay.

is found to be prevalent in the Riefeling garage because the proprietors believe in the theory of least time consumption. The new tools are also better for handling the cars, not only saving the energy of the employees but saving much wear on the body and parts. The jack that formerly held a machine up while the mechanic crawled under is discarded

and new pulley methods are employed. There now is no hazard to the man underneath.

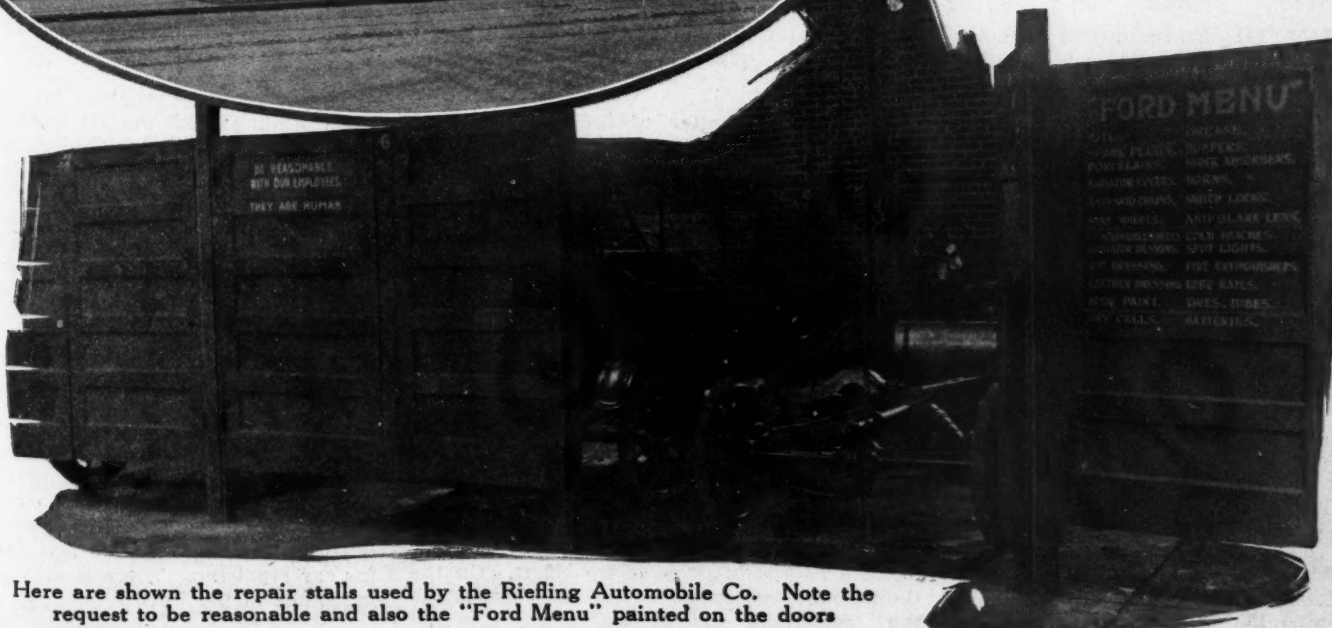
Pliers and monkey-wrenches are totally abolished in favor of socket-wrenches which save the bolt or nut and spare hours of time weekly. It is this actual saving of time and conservation of energy which has been a factor in the Riefeling successes. There is no doubt about its efficiency.

Treatment of employees as human be-

(Continued on page 41)



Exterior of the Riefeling Automobile Co.'s novel sales and service station





Exterior of the Gem City Auto Co., showing the general neatness. Note the show window on the side

BUILT FOR A TASK

Fireproof Structure Planned and Built to Efficiently Care for Sales and Service

WITH the realization that the right kind of a building is one of the first requisites to properly sell and service cars, the Gem City Auto Co., Frankfort, Ind., set about and recently put up a building especially well suited to its needs.

The material used throughout the building is steel, brick and concrete. The ceilings of the entire structure are built of steel and plastered, the plaster being covered with a white calcimine that gives the place a decidedly clean appearance and adds to the natural and artificial lighting facilities.

To give an idea of the solidity of the construction it need only be said that the floor dividing the first and second stories contains 22½ tons of steel, 18½ tons of cement and 315 yards of gravel, weighing about 1½ tons to the yard. There is not a post or support of any kind in the entire building. With the exception of the room occupied by the

elevator the floor space of the entire garage proper is available for storing cars.

In the matter of fireproof construction, even the minutest detail was not overlooked to make the building absolutely perfect in that respect. In that portion of the building designed for the storage of cars, and with the exception of the floor of the elevator, there is not enough exposed wood out of which to make a match.

No Woodwork Exposed

And there is very little wood exposed in other parts of the building, merely the window casings and doors of the salesroom and stock room, and these compartments are shut off from the main part of the garage by steel covered doors, some of which close automatically.

The building is 66 by 132 ft. On the southwest corner of the structure is the salesroom and private office, covering

42 by 35 ft. of floor space. On the opposite side of the driveway or front entrance to the garage is a stockroom 18 by 26 ft. At the rear of this room, with entrances from the main floor of the car storing department are separate toilets for women and men, and in the basement under the stockroom there is a tire and oil compartment 18 by 35 ft.

Preventing Greasy Floors

There is a drip provided in the basement leading from the oil pump in the driveway overhead, which was an idea of Mr. Miller to prevent unnecessary waste of oil and which, in connection with the drip where the oil is measured from the pipes, will assure absolute freedom from greasy floors. There is a hand elevator, or lift, that connects the basement with the storage room that will greatly facilitate the handling of tires and oil containers.

One of the finest features of the garage is the workshop that is in the front part of the building on the second floor. The shop is 35 by 66 ft. equipped with track and hoist for the easy moving of cars from one end of the shop to the other, and all other tools and facilities for car repairing. There is also a welding outfit in the workshop.

(Continued on page 23)

A Commission on Repair Parts

Foreman of the Shop Gets Commission Above Salary For All Material Used, Which Insures a Close Inspection on Each Job—Two Forms Keep Service Records

BY giving a commission, above his salary, to the foreman on all new parts sold for repair work The Northern Kentucky Motor Car Co., Augusta, Ky., has just about doubled the sale of repair material. This also tends to make the foreman give each car a closer inspection.

Most owners leave their cars to have just a certain few repairs made which they happen to know are needed. The average shop does that work and lets the car go out, while here the foreman goes over every car coming in for repairs and if he finds some worn part needing repairs or replacement he phones the owner about it and nine out of ten times he is instructed to make the needed repair.

On this page are also shown two forms used by this company that make a very complete service record. On one side of the repair tag the instructions for the work are made very clear also that the owner has signed the card and knows just what is to be done on his car before work on it is started. On the

Below is reproduced the reverse side of the repair tag which is a record of all the repair parts and material used

Below is reproduced the reverse side of the repair tag which is a record of all the repair parts and material used

PARTS AND MATERIALS USED		
QUANTITY	ARTICLE	PRICE
2#	Cup grease	60
1 pt	Lub oil	15
5#	Trans grease	1 25
12 1/2#	Wash lining	20
4 doz	Wash	40
1-334	General credit	43 35
		52 95
3-21-20		
Mains	7-10-11-12-1-5	8 1/2
Norm	7-12-1-5	7 1/2
	Total	17 1/2
Jewie	Wash patch 5-630	1 1/2
	17 Wash patch @ 12 1/2	20 25
	Wash patch	2 00
	TOTAL PARTS	22 25
PARTS	52 95	
LABOR	22 25	
TOTAL	75 20	

REMARKS: *Time taken to repair car*
need new material
grease, and
new car wash
from owner

Northern Kentucky Motor Car Co.
 Augusta, Ky.

reverse side of the card a record of all parts and material used on the job is kept by the mechanics doing the work and must compare with requisition which is kept in the stockroom.

The stock keeper keeps a requisition of all parts used on the job, and when the job is completed the repair tag is given to the stock keeper who totals up the amount for parts and material used and then turns the card into the office where the time is figured and the bill is totaled.

Each mechanic keeps his time on the back of the card. If he leaves this job for another, he checks out, and if he returns to this job he checks in again.

The mechanics are paid from their time which is on these cards. If they fail to put their time down on the card, they lose their pay. If their time shown on these cards totals only seven hours at the end of the day, they are paid for only seven hours, but with this system they are very careful to put down their exact time on each job. This plan makes it sure that no work will be done on a car without a record of the time and work done on it. This record is their only time card. These cards are filed after the bookkeeper makes a charge for the job, and if at any time the owner wants to know what was done to his car or what was used in repairing it, we can turn to his card and show him what was done, what was used, who did the work and how long it took to do it.

REPAIR TAG No. 914

NAME OF CAR: *Oldsmobile* OTHER: *Kline & Neil* DATE: *3-31-20*

REPAIRS WANTED

Motor: *burn carbon, grind valves*
 Clean & adjust carburetor
 Transmission: *grease*
 Clutch: *put in new lining*
 Differential: *"*
 Steering Gear: *take out play*
 Generator: *oil*
 Magneto: *overhaul*
 Distributor: *"*
 Battery: *water*
 Body: *tighten bolts*
 Springs: *grease*
 Brakes: *adjust - front & emergency*
 Radiator: *repair leak*
 Pump: *pack*
 Front Axle: *straighten*
 Rear Axle: *"*
 Front Wheel: *take up bearings*
 Rear Wheel: *"*
 Greased: *"*
 Tires: *put on 334 General credit*
 Wiring: *"*
 Wash: *grease*
 Polish: *"*
 Incidentals: *test for power on tire*
 Final Test: *"*

Owner Signature: *W. H. Harrison* FOREMAN
 Owner Signature: *K. H. Neil*

FORM 45 REQUISITION ON STOCK ROOM Date: _____

Owner: *Kline & Neil*

Make of Car: *Oldsmobile* Repair Order No. *914*

Model: *16*

QUANTITY REQUIRED	PART NO.	ARTICLE	PRICE	AMOUNT
2#		Cup grease	30	60
1 pt		Lub oil	15	15
5#		Trans grease	25	1 25
12 1/2#		Wash lining	60	7 20
4 doz		Cup grease	10	40
1-		General credit	49 35	
		Correct W. H. Cabin		
		TOTAL	52 95	

Ordered by: *Mains-Dorn* O. K. *W. H. Harrison* Foreman

These are the two forms used by the Northern Kentucky Motor Car Co., Augusta, Ky. Note that repair tag is signed by owner. These forms are filed with bookkeeper for future reference

Meeting Truck Owners All the Way

A Twenty-Four Hour Service Plan for Trucks Keeps Them Running at Maximum Efficiency

THE Russell P. Taber, Inc., Hartford, Conn., feels it is not selling automobiles and trucks. Rather it is selling passenger car and motor truck transportation and the attendant service that keeps these vehicles up to the necessary standard of efficiency. The company considers it an obligation to its customers to render to them every possible aid that will tend to make the use of their trucks a money-making venture. In fact, the company will not sell trucks unless it knows that the customer will make money with the truck. It prefers to pass up the sale. Much of the company's success is attributed to service by E. M. Taber, vice-president. The company is distributor for Peerless and Reo cars and Republic and Duplex trucks.

The house always carefully analyzes all conditions of a given service, and when the time comes to talk to the prospect knows fully just what is to be required of a car. Every salesman must be able to figure costs with his prospect.

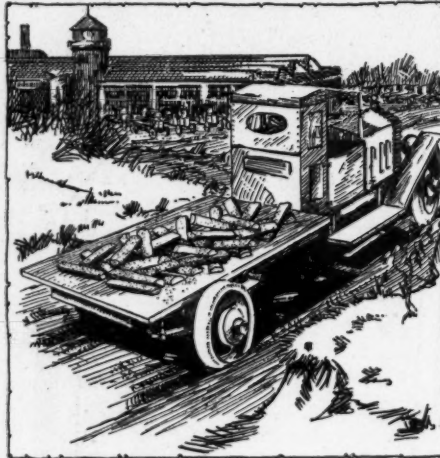
The company's service first came to notice when the so-called free variety was exploited. This provided a purchaser with fifty hours of labor, gratis. Mr. Taber was the pioneer in this liberal service policy which was so prolific of good results that contemporary dealers followed suit, some even giving more than Mr. Taber. However, the pioneer possessed a commendable quality, the personal touch.

And while the vice-president may be perfectly right in saying the concern owes its success to service, sight must not be lost of the fact that the head of the house through his personality has been an inspiration. It goes without saying that the business of the firm has increased from season to season.

Service Should Be Paid For

There is no more free service, that is not in the sense that it obtained in other years. Past experience has shown that the free service policy means a considerable amount of money. Service, as a matter of fact, is something one should pay for. One pays for service in a Pullman, in a well appointed hotel, on a steamship or elsewhere, and, when one gets what one wants one is pleased. Why not pay for truck service? Why should the owner expect that the vehicle be kept in repair for an indefinite period without cost to him? In the final analysis service is by no means something for nothing.

It is also a fact that the brand of service that is accorded by the Taber organization to-day and for which a charge is made is vastly better than the brand that was formerly given gratis. Of course there is the factory guarantee



"When trucks are received from the factory they are fitted with platform bodies on which is loaded enough pig iron to make up a capacity load. The truck is then sent over a measured course, involving all kinds of going. A full report is then sent in by the tester"

and in all cases where a just credit is due the owner gets it.

One fact brought home to him was that many owners of cars sold by his house were neglecting their trucks. Some badly overloaded until it seemed as if the springs would break and so on. Then there were needed minor repairs which the owners did not deem of sufficient importance to tie their cars up a day for when they could make more money by using them even though they took a risk in doing so. Mr. Taber said, "If these fellows cannot and will not come in with their cars during the day they surely can and will come in with them during the night." And so he inaugurated a twenty-four hour service plan. It worked from the start. The money-making truck stays on the job all day and comes in at night for repairs. It is ready to go on the job again the first thing in the morning.

Extra Charge for Night Work

An additional charge of 20 per cent is made for night work but the average owner is only too willing to pay the extra charge to have his car put in order without pulling it off the job in the working period. The work is now being done and that is the big idea.

From the inception of the automobile industry there have been concerns that knew just how all or nearly all of their

cars were performing. It is quite the case with Taber. He knows how every car is working through a system of inspections. This information is always on file. Suppose for the sake of argument that a truck owner complains that a certain part has gone. He hunts up the inspection reports and comes back something like this: "Your car was thoroughly inspected on the 17th of last month. Here is the inspector's report. A copy of it was delivered to you, together with the recommendations of the service manager that certain work be done in order to make your car what it should be. Clearly you have neglected lubrication. You were advised to change the part when the report was sent you."

There's the whole story in a nut shell. Concrete evidence. And it is so with all cars sold. The inspection phase of the service provides for monthly inspections. These begin the first month after the truck is delivered. Three monthly inspections are given without cost. After that they are made at \$3 per month.

Inspection by Good Mechanics

The work of inspection is entrusted to thoroughly good mechanics who have been with the company a long time. They know the cars thoroughly. These inspectors have regular rounds to make using passenger cars to get about in. These cars are conspicuously lettered so that any truck driver who has trouble on the road may not hesitate to hail the inspectors. If the car which the inspector is to test is off on the road, it is up to him to locate it and put the machine through the paces. His findings are to be reported on a special blank on which there are spaces for notation on all matters pertaining to the condition of the car. The inspection is very thorough. On his return to the service station the inspector files his report in duplicate, one copy being retained by the office, the other going to the owner. The recommendations of the service manager accompany the report. These inspections, together with the new 24-hour service policy have materially increased the efficiency of the organization.

There is another phase that may be classified as preliminary service. When trucks are received from the factory they are fitted with platform bodies on which is loaded enough pig-iron to make up the capacity load. The car is then sent over a measured course which will involve all kinds of going as well as steep grades. A full report is presented by the tester. Then there is definite knowledge as to the actual worth of that truck. This means that the buyer has not only the assurance of the factory but that of Taber as well. These preliminary tests have worked out very well.

Reproduction of the Inspection Form Which Keeps a Close Check On Trucks

[illegible]

Parts must necessarily be considered as service. Mr. Taber carries a \$50,000 stock. A minimum is set for each part and when this is reached more parts are ordered. And the minimum is sufficiently high to ensure there being parts on hand until the new orders arrive. In contradistinction to other local truck services where the owner would have to wait until the dealer could get parts from some other city, he has them in stock and finishes up the work promptly. A case of long and patient waiting is emphasized by the experience of a local contractor who needed a new transmission shaft. The dealer hadn't the part in stock, tried to get one in New Haven and finally resorted to a long distance telephone conversation with the factory to get the part through. The truck was useless during a very busy period. Contrasting that experience with Taber service in the latter instance a new transmission would have been installed to keep the car on a money-making job or the needed part added. Service is largely a matter of seeing the proposition from the owner's angle.

Service Used As Sales Asset

That truck owners in remote sections of the Taber territory might get quick service, branch stations were established at Meriden and New Britain. The same policy prevails here as in the home office.

Service is used as a sales asset. The salesman takes his prospect over the plant, explains every phase of the service, the monthly inspections, the preliminary road tests and so on.

With every piece of mail matter that goes to customers, there is an enclosure of one sort or another, a neat piece of printing that is bound to attract notice.

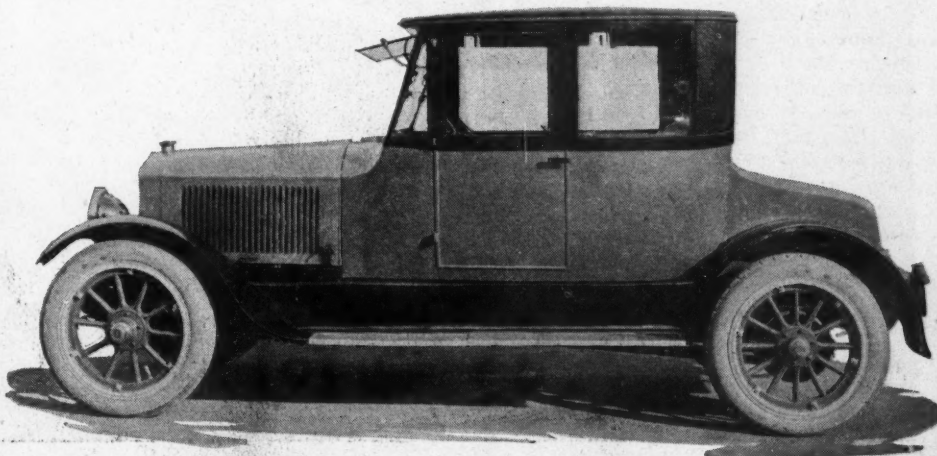
Part of the service a Taber salesman is expected to render a prospect is to figure his costs for him.

The salesman is expected to know all the angles on the prospect's business and be able to give him at a moment's notice all the cost items in connection with that business.

A record is kept of the result of every inspection by the tester

New Stanley Steamer Coupe Design

The touring coupe shown here is the latest Stanley Steamer model. The lines have been vastly improved over previous designs, and it can be truthfully said that the Stanley is now a good looking car. The body is mounted on a 130-in. wheelbase chassis. A two-cylinder steam engine connected directly to the rear axle, supplies the power, and from this two-cylinder engine there is derived four power impulses per revolution, the same number as in an eight-cylinder gas engine. The steam after passing through the engine is condensed in the radiator-like condenser, located in the conventional radiator position. With this equipment the car is able to travel something like three hundred miles on a filling of water, under favorable conditions.



The body of the new Stanley coupe is mounted on a 130-in. wheelbase chassis. Will operate 300 miles on a filling of water

Systematizing Engine Work

Adaptation of T-Wagon to Dealer's Engine Service Work Enables Parts Arrangements in Chronological Order to Facilitate Assembly

SYSTEMATIZING the act of tearing an engine down may sound a bit far fetched to some, but as a matter of fact, there is no service job on a car, truck or tractor, that can be systematized to a greater extent than can the work on the engine.

This systematic work on the engine can be accomplished only with proper equipment. There are many times, we feel, that recommendation of shop equipment passes by unheeded simply because of the necessary outlay to obtain the equipment. It has been necessary to purchase nearly all of the equipment *MOTOR AGE* has recommended from time to time, and because of this there are many service stations that we have not reached. We are showing here, one article of equipment that any good mechanic can make and the outlay is small, involving only the cost of the lumber, the mechanics' time, and the few other miscellaneous parts of the stand.

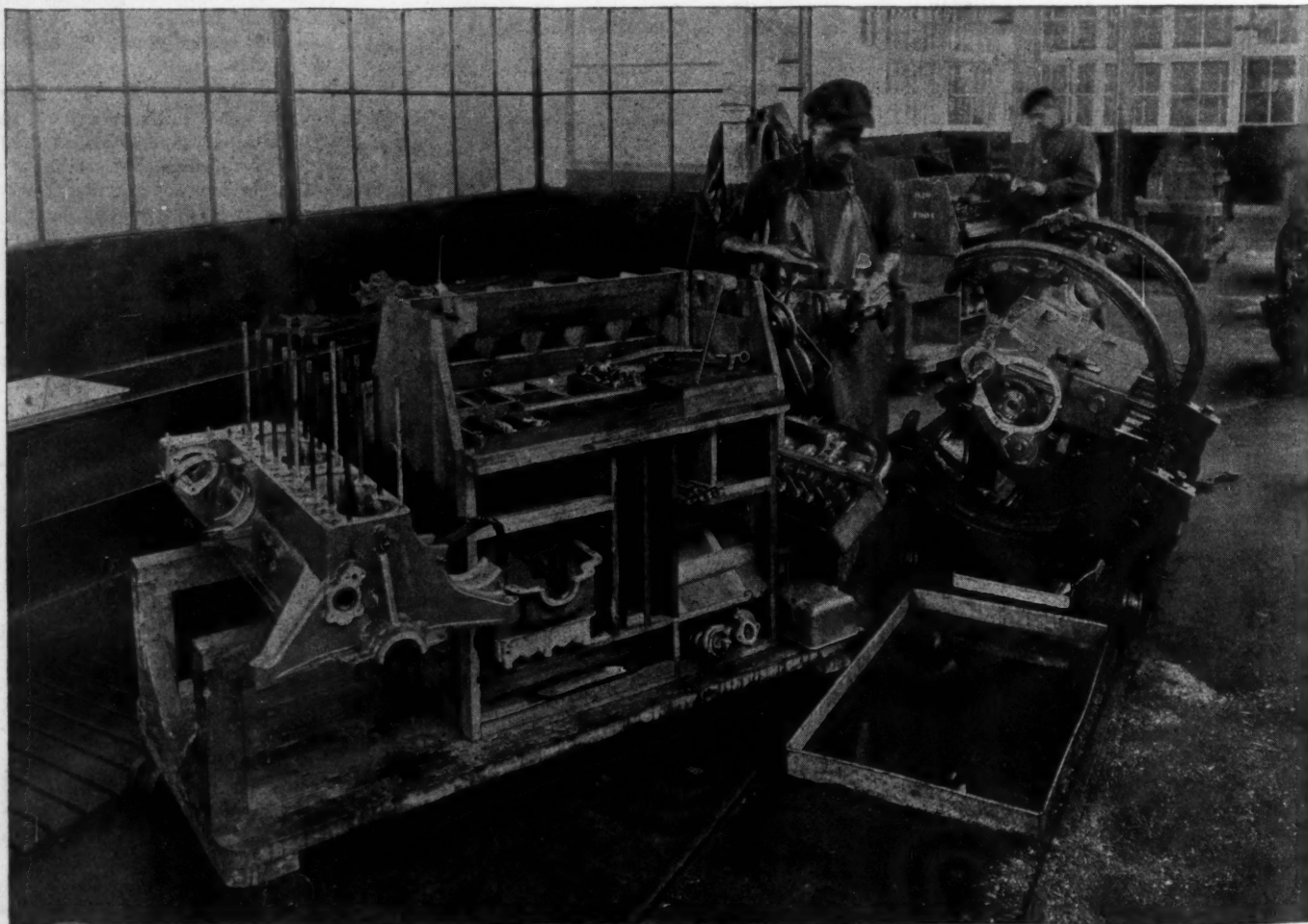
The T-wagon for engine parts shown herewith is an adaptation from the practice used by the Nordyke & Marmon Co., which they used extensively while building Liberty engines, and it no doubt was measurably responsible for the success they obtained, winning the distinction as the "Champion Liberty Engine Builders." The stand shown in the illustration is a modification of the one used for the Liberty engines, and as shown it suits the requirements of the Marmon engine.

Build to Requirements

It should be borne in mind that a stand of this type is built for one type of engine only. For example a Dodge dealer doing extensive repair work on the Dodge car should build his stand to suit the requirements of the Dodge engine. In the stand shown, compartments are provided for all the engine parts

and they include a space for each connecting rod with pistons attached. The carbureter has its position, a support for the upper half of the crankcase is provided on the left hand side as shown. The push rods have each their individual hole to fit in. All nuts of a certain size go in a certain space. Washers go in their respective places.

The gasket for the cylinder head hangs on the side of the upright as the other view of the stand shows. The crankshaft is placed across the top, in the convenient notches that are provided for it. In this way, the mechanic is aided a great deal while taking the engine apart. With a place for every part, one is able to tell instantly whether or not all the parts are at hand, whereas, should any of the parts be missing and the parts scattered around in a promiscuous manner, without system or order, it is very difficult to tell whether all of the parts are there.



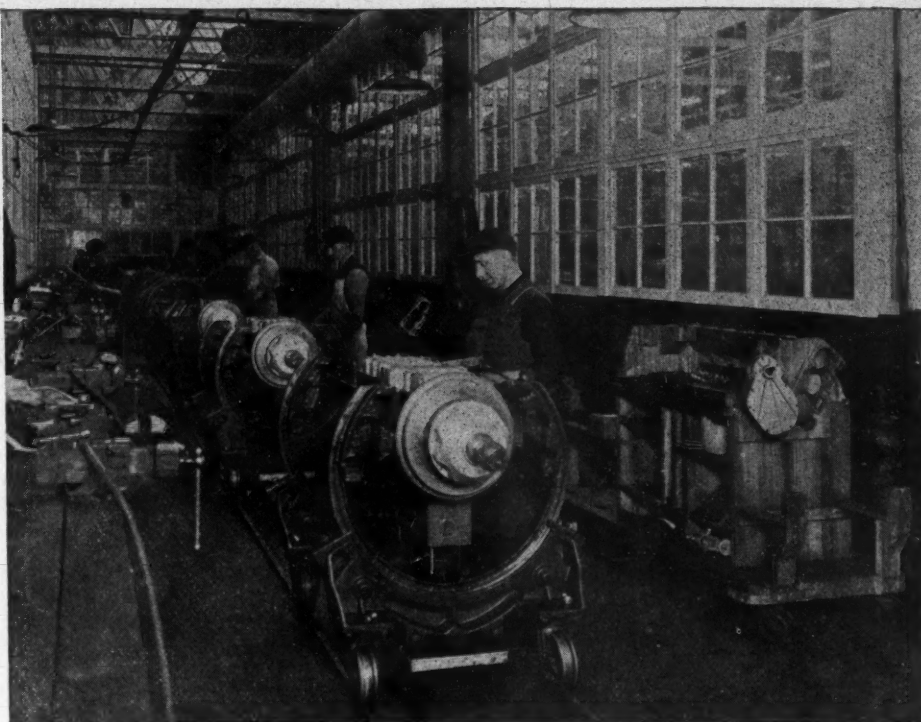
A view of the T-wagon as used by the Nordyke & Marmon Co., which can be adapted to the dealer's shop, for service work on the engine

If the engine is taken apart and the parts placed aimlessly about on the bench, it is doubted very much whether any man could tell instantly just where all the push rods were, and whether they are in good condition. This is the main purpose of the T-wagon. It is not so much the idea of having a place to put the parts when you take them out as it is to tell what parts are there and what parts are missing.

An excellent scheme in connection with the use of this T-wagon, is the way parts orders for an engine can be facilitated, both in billing and ordering the parts from the stock room. For example, suppose one has an engine all apart with the various parts in their respective positions in the tray. After looking over the small bins and compartments, it is found that the bin which should have fifteen cap screws in it, contains only thirteen cap screws; that the compartment for the oil pipe leads contains a cracked pipe lead, and that various other parts are missing, or need replacement for other reasons. A note is then made on the parts order list which is tagged to the engine while it is being worked upon.

Time Saved in Assembly

In this way duplication of trips between the stock room and the work is eliminated. Time is saved and the job can be assembled much more rapidly than if the parts were within a few steps' reach on the bench. If an engine were completely dis-assembled and placed on a bench, and the assembly commenced with the engine stand but a few feet away, say 6 feet from the bench, about 1000 to 1200 steps would be necessary to assemble the engine complete.



Another view of the T-wagon showing how every possible place on the tray is utilized for convenient arrangement of the engine parts

As regards the actual construction of the T-wagon, we do not think it best to lay down any one plan and state it to be the right parts tray to suit all conditions. A tray to suit the parts for a Dodge engine will not be the same as one designed for a Packard engine. Heavy and massive construction is necessary in the make-up of the tray. The one shown in the illustration shows this point very clearly.

Using such a heavy construction is

apt to produce an unsuccessful parts tray, if the proper sort of wheels or casters are not used. No one wants to push with all his strength in order to move the tray from one car to the next. A large roller bearing caster wheel, equipped with solid rubber tires, should be fitted, or else a good iron wheel. There is some little objection to the use of rubber tires on the caster wheels because of the deteriorating effect of oil on rubber, but this should not prove to be so very objectionable.

Piston Clearance for Iron and Aluminum Pistons

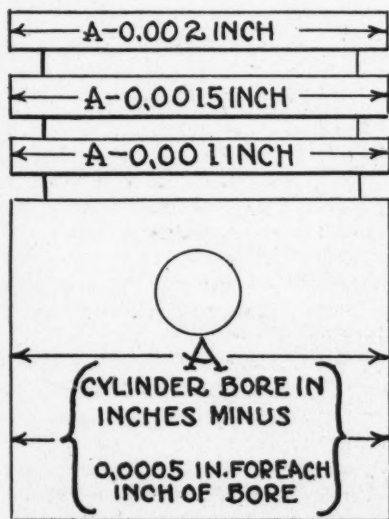
"How much clearance should there be between the piston and the cylinder bore?" is the question that very many

mechanics are in doubt about. There are two kinds of pistons in general use and each kind, because of the different degree of expansibility of the metal, of which they are composed, requires a different clearance. Iron pistons expand a certain amount, which can easily be calculated by estimating from the coefficient of expansion of iron. If we were to take a bar of cast iron, say 1 ft. in length, and heat it up 100 deg. F., its length would then be 1.000591 ft., not very much, but still enough to warrant an allowance for clearance. With a piston, the temperature is apt to vary to something like 1000 to 1500 deg. F., which makes it the more imperative that a certain clearance be allowed.

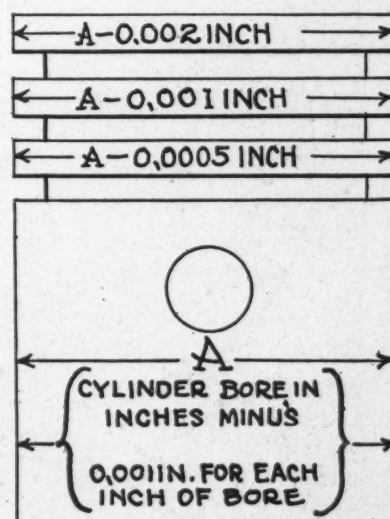
The illustration shown to the right is representative of regular practice for iron piston clearance. It means that a piston should be ground so that the skirt measures less in diameter, by the same number of thousandths inch, that the bore measures in inches. In other words make the skirt of the piston 0.003 in. less in diameter than the bore of the

cylinder for a 3 in. cylinder, 0.004 in. less in diameter for 4 in. bore and so on.

(Continued on page 32)



Iron piston showing proper clearances for all diameters



Aluminum piston showing proper clearances for all diameters

NEW TYPE ENGINE BEARING

By Cushioning Shafts On Unbreakable Oil Film, Long Life Bearings are Produced

BY ROY E. BERG

A DISTINCTLY new type of bearing construction is now being noted in the latest designs of internal combustion engines. Strange as it may seem, one would think that an engineer would hardly sponsor the idea of an engine bearing built so that it will not wear, but this is the aim at present of a few well intentioned engineers. The whole idea, expressed briefly, is that, if a metal to metal contact can be prevented between the bear-

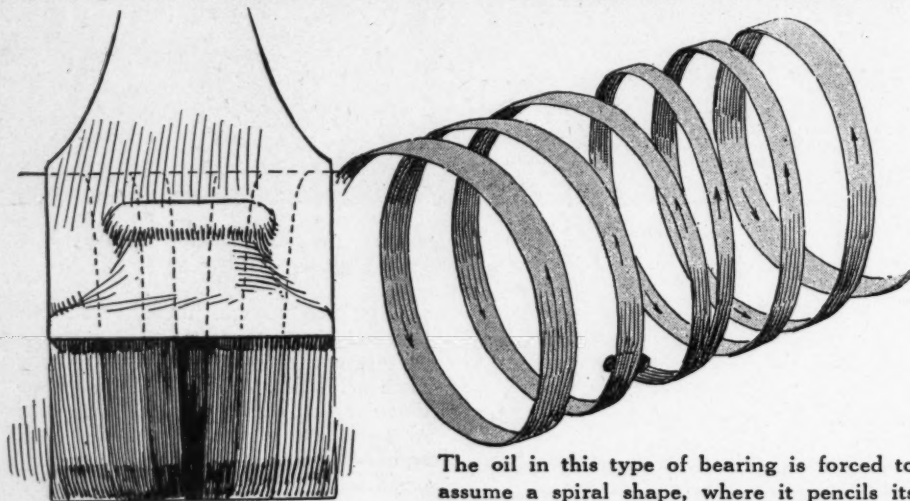
ing and the journal, there will be no wear. This, in days gone by, would have been termed the "Utopia of the Machine World," but in this modern day when one has but to exclaim a desire for something hitherto unattainable, presto! and some engineer works it out.

Fifty thousand miles on a set of bearings, without ever taking them up, or in fact paying any attention to them at

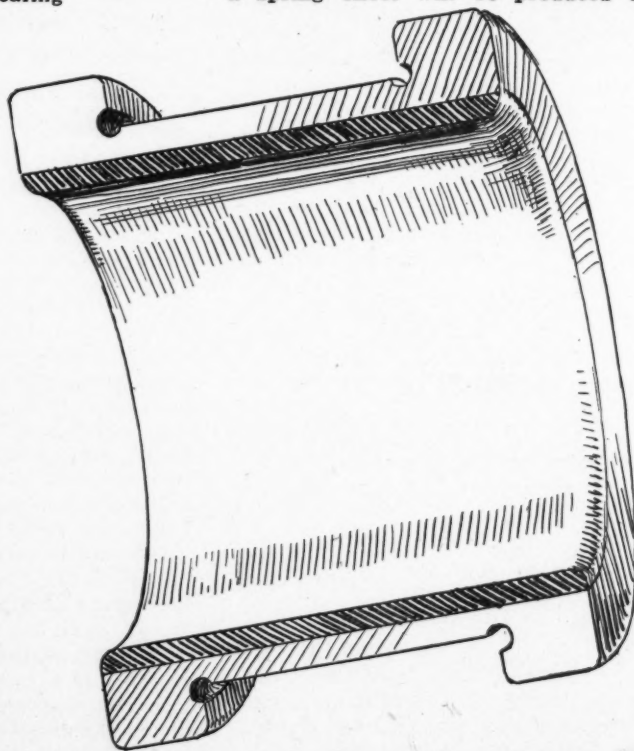
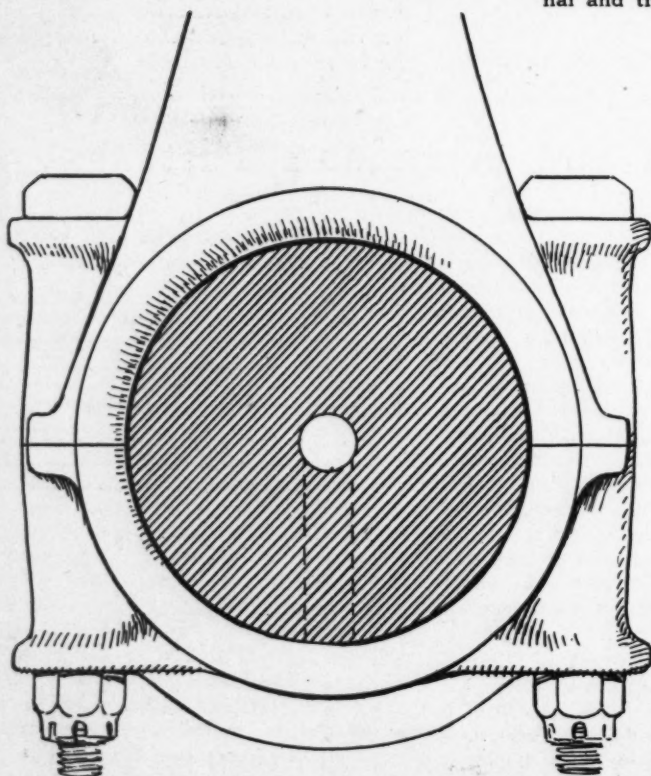
all,—providing, that the lubrication is taken care of! This is the claim of those who are responsible for these latest type bearings.

For the achievement of these stupendous results, reliance is placed on the cushioning effect of oil. But in order to take full advantage of this cushioning effect of any lubricating medium, some departures from previous set standards of construction are necessary.

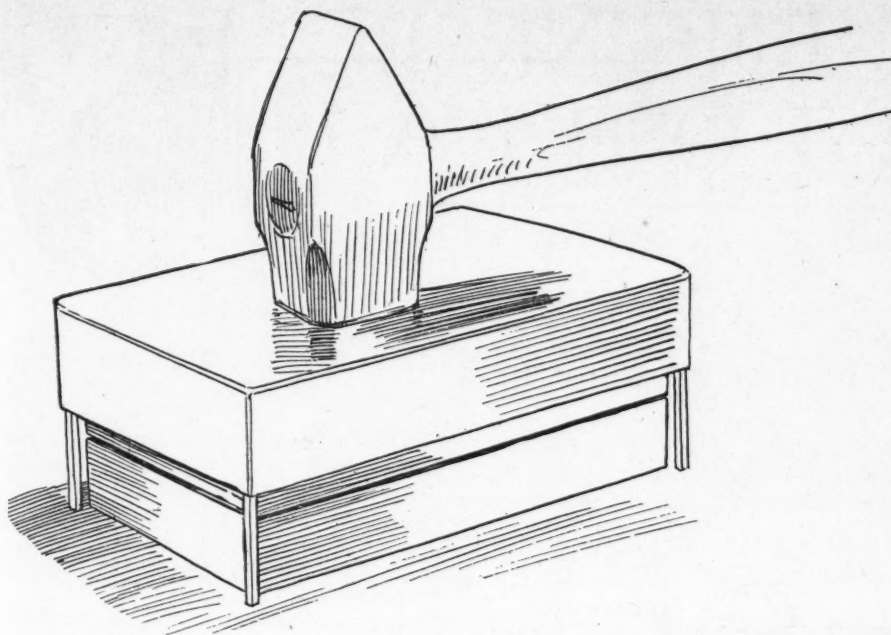
Let us suppose that, to illustrate just how efficient a cushion of oil is, that we take a metal block with a perfectly smooth surface, supported on a level surface, and cover this block with coating of oil. The film of oil need not be very thick, just enough to insure that the whole surface is covered. Then support over this metal block another block. This second block should be supported on three or four match sticks, cut to the proper length, so that the upper block will be just a short distance above the lower block, say $\frac{1}{8}$ to $\frac{1}{4}$ in. Now by striking the upper block a heavy blow with a maul, or some other heavy hammer, the supporting match-sticks will be crushed and the upper metal plate will be crushed down upon the lower plate with all of the energy of the hammer blow. Because of the cushioning effect of the oil film between the two plates, a spring effect will be produced that



The oil in this type of bearing is forced to assume a spiral shape, where it pencils its way out through the space between the journal and the bearing



This shows how the oil film is maintained entirely around the bearing. No shims are used and the joint between the bearing cap and rod is as close to a perfect fit as human skill can make it. The inside of the bearing is perfectly smooth. No oil grooves are cut in the surface of the babbitt metal



Illustrating the effect of an oil cushion. A blow struck the upper block which is supported by match sticks will produce hardly no noise when the upper block strikes the lower block. The small match sticks will of course be shattered, their strength being insignificant when compared to the force of the blow

will prevent any sudden application of the energy to the lower plate, that is speaking comparatively of the results that would be obtained without an oil film between the plates. However, if the upper plate were so constructed that an oil groove were placed in its surface, the film would be broken, and the cushioning effect would be destroyed.

The condition described above is that obtained in this new type of bearing construction. No oil grooves are used. No adjusting shims are used. The junction between the lower cap and the upper half of the bearings are fitted perfectly to each other. In this way the interior surface of the bearing is perfectly smooth. It has no projecting ridges in it, and there is no opportunity for the oil film to be broken. When the pressure comes on the bearing from the pressure of the explosion, the oil film is not broken up and allowed to collect in the grooves, for there are no grooves. The oil is not squeezed out between journal surface and the bearing surface, because of the viscosity and the cohesive attraction of the oil for the metal surfaces.

Large Shafts An Advantage

Another condition that makes possible the maintenance of such a perfect oil film between the two surfaces is the large sized shafts that are being used. A certain four-cylinder engine, which in previous years would have been equipped with a 1½ in. shaft, is now equipped with a 3-in. shaft. Such an immense sized shaft is extremely rigid. There is very little tendency for a shaft with so much metal in it to develop any whip or periodic vibration. With the tendency toward rupture of the oil film greatly reduced by the practical elimination of the crankshaft vibration, lubri-

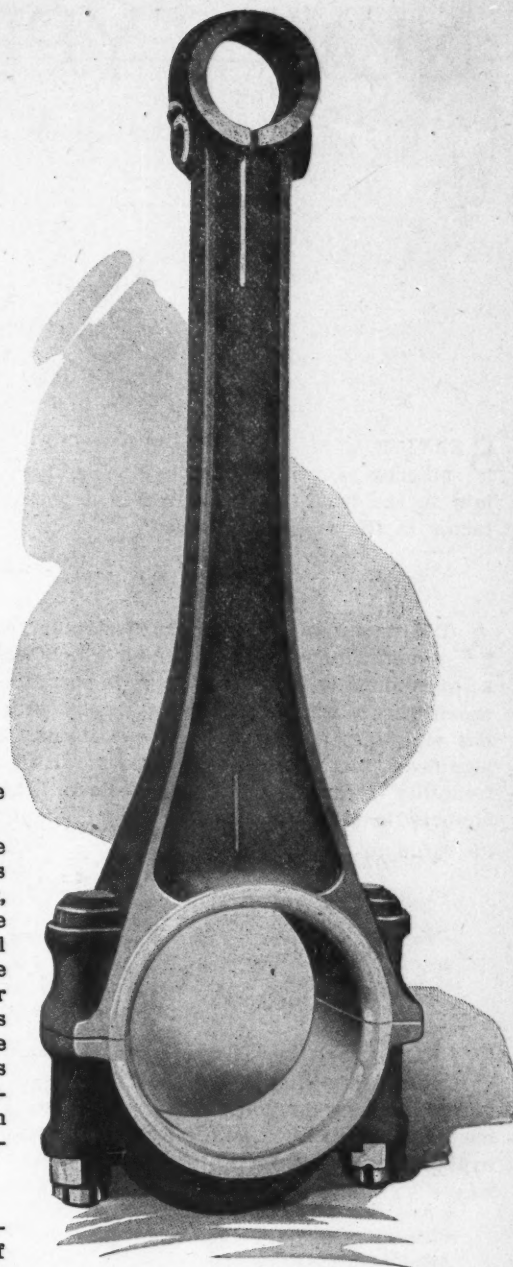
cation is still further facilitated and the bearing life enhanced.

Still other precautionary measures are being taken to insure that these bearings are going to last a long while, at least, is the peculiar way in which some are casting the Babbitt metal. Babbitt metal is at best, but a soft metal that can be pounded into most any shape. Under sufficient pressure a soft metal of this kind can be made flow from an orifice just as if it were water. In fact this is the way wire solder is made, and Babbitt is not so essentially different from other soft metals, like solder, for example.

Babbitt Takes Pressure Direct

If water is poured into a container, the water assumes the shape of the container. If pressure is applied to the water by forcing a plunger into it the water will tend to run out of the container, but if the container fitted sufficiently tight around the plunger so that the water would not escape, the plunger would rest on the water. In a way this is the effect obtained with these new type bearings. The Babbitt metal is forced to take the pressure direct, but since a very rigid container, fits the Babbitt around its entire surface, the pressure is transmitted through the soft metal to the bearing backing. Thus the bearing metal is given strength to resist any attempts to pound it to pieces and since the tendency toward a shaft vibration has been greatly reduced the bearings are insured for long wear.

As was said before, bearing metal is essentially a soft metal which makes it an ideal metal for friction reducing purposes. Because of its softness special means have been devised to cast the metal directly into the bearing backing. One firm casts the metal into the bearing back by means of a centrifugal



A connecting rod of this type. Note that the interior of the bearing surface is perfectly smooth. The flanges of the rod are tapered out as shown to evenly distribute the stress to the whole of the bearing surface

device. This revolves the whole bearing very rapidly and the molten metal is thrown forcibly into the bearing backing. In this manner a very dense solid metal is produced having all the wearing qualities of the ordinary Babbitt but having the advantage that it wears very well. One other advantage that is not so apparent at first thought, is the excellent heat dissipating qualities that such a bearing has. It should be remembered that with the large bearings in use, there is apt to be a large quantity of heat generated by the revolution of the journal in the bearing.

To show just what a difference this makes in the distance travelled by a point on the surface of a large shaft and

(Concluded on page 32)



EDITORIAL



Service as an Influencing Factor in Truck Design

SERVICE, at first an unheard of and an apparently insignificant part of the automotive industry, now makes its bow to the truck manufacturer as a potent and influencing factor in the design of trucks.



AT a recent meeting of the Society of Automotive Engineers, a paper was presented which was in the form of a questionnaire. Several very important questions were asked regarding the design of trucks with a view toward the simplification of service operations. This is a most significant fact. It shows what a powerful argument "serviceability" means to the truck salesman. It shows the manufacturer is alive to the situation of simplified service and its value to his truck.

COMPANIES operating large numbers of trucks are not asleep to the service situation either. One of the largest truck operating companies in the country now buys its trucks on a service basis. The total cost of the combined standardized service operating costs must be less than a certain percentage of the cost of the truck, or this company won't buy the truck.



WHEN the day comes, that all cars, trucks and tractors can be purchased on the basis as outlined above, part of the great mission of MOTOR AGE will have been fulfilled. Further efforts must then be given to lower this percentage cost, so that the combined service and operating costs will be a constantly diminishing part of the total cost.

Make Sure Your Cars Are Ready

WHEN you deliver a new car to a customer do you know that everything about the car is right? If you do not you are making your first service mistake. Disappoint a new customer at the start and it is going to take a great deal of explaining and so forth to win him back to the point of where he thinks well of your business methods.



NO one expects the dealer to go over the whole car and take out the various units to see whether or not the factory did this or that. We expect our factory inspectors have done the necessary work along this line. But we do expect the dealer who turns over a new car to a customer to have gone over it pretty thoroughly, so that the latter does not have to come back the next day and make complaints which clearly point to carelessness on the dealer's part. Accessories and parts are sometimes stolen or lost in transit and it is the dealer's duty to see if they are all there.

WE have in mind an incident of where a customer was turned loose with a new car which became stalled only a few miles from the dealer's place and the driver was helpless as to how to proceed to get the engine started, especially when he had been told that everything was all right. He telephoned the dealer's place and a man was sent out. Inspection revealed that one of the battery terminals had loosed. Further inspection revealed that the threads on the bolt going through the negative terminal were stripped and the mechanic making the installation at the service station had merely wrapped the terminal with a little wire. This shook loose and left the car owner stranded.



SOMETIMES a car is sent out on which the doors do not close absolutely tight. A little filing will help this, but the time to do it is before the customer comes in and complains about it. Forestall rather than correct trouble.

To Our Readers

Your failure to receive this week's edition of Motor Age was occasioned by the railroad strike which prevented freight shipments to and from Chicago. Paper on which this week's issue was printed was brought to Chicago by motor truck. See next week's issue for an interesting story of how the motor truck came to the rescue of Motor Age, "Motordom's Authority"



Motor trucks came to the rescue of Chicago when an unauthorized strike tied up all the freight yards. Within a few hours after it was known that the refrigerator cars would not be moved motor trucks were put into service in their stead to deliver food within a radius of fifty miles in all directions from the stock yards

Motor Trucks Aid in Chicago Rail Strike

Packing Concerns and Other Industries Keep the Wheels Turning by Reliance on Gasoline Vehicles.

CHICAGO, April 12—Once more the motor truck has been called upon to keep Chicago's business running. Without the truck this week, the strike of railroad yards switchmen probably would have completely paralyzed some of Chicago's most important businesses. As it was, however, the trucks performed such valiant services that "the man on the street" scarcely was aware that the city faced one of its most serious transportation crises.

An unauthorized strike of switchmen employed in the Chicago freight yards was called about a week ago, the men going out contrary to the orders of their officials and in violation of agreements with their employers. The number of strikers varied from an estimate of 3500, made by the employers, to a claim of 14,000 by the strike leaders. Whatever the number, it was sufficient completely to tie up all freight shipments into and out of the city for several days, and even now the situation is extremely serious.

Probably the most important industry seriously affected was the packing industry. In its very nature the meat packing industry is vitally dependent upon continuous freight service. No stocks of cattle for slaughtering can be accumulated in Chicago to tide the meat industries over a period of more than two or three days at most, and it is equally impossible for the packers to keep fresh meats in their plants more than a day or two.

The packers, however, called upon the motor trucks and saved the situation. The big fleets of motor trucks employed by the great packing firms were called

upon to take up the tremendous task of supplying the branch houses and car route stations within the Chicago zone. Within a few hours after it was definitely known that the wheels of refrigerator cars could not be turned, new systems of motor truck routes were laid out to cover a zone stretching fifty miles in every direction from Packingtown. Every available truck was requisitioned for this long distance service while city transportation was turned over largely to lighter vehicles.

On the second day of the shutdown, motor trucks of Swift & Co. carried fresh meat and prepared food products to the extent of 400,000 pounds in excess of their normal truckage. In addition to the regular fleet, ranging in capacity

from 3½ to 7 tons, a number of vehicles were engaged from outside sources in order to meet the heavy demands of the Chicago territory.

Similarly, other big industries in Chicago were forced to turn to the truck to keep their wheels turning. In many instances it was found that freight consigned to Chicago had got as far as cities from fifty to 100 miles from Chicago, where the cars were held up. Business houses were kept busy tracing these loads and once located trucks were dispatched to the cities, the cars unloaded and the freight brought into Chicago by truck. Almost every sort of commodity was handled in this way, with the result that Chicago's business was saved from a complete paralysis.

BUILT FOR A TASK

(Continued from page 14)

Automatically closed fire doors separate the work shop from the second story storage compartment. Prism glass, set in steel sash, the windows being close together, afford all the light that will be necessary even on the darkest days, and the glass will shut out the glaring rays of the sun on the brightest days.

The big 6-ton elevator for raising cars to the second story is electrically controlled and cars can be driven on to it from either end, thus avoiding waste of time in turning and twisting to get on the elevator. The front driveway is 12 ft. in width, and there is a rear entrance or exit at the north end of the building to a paved alley.

An air pipe is attached to the elevator

walls on both floors. An automobile air compressor provided air for both floors of the garage, the workshop and also at the curb outside. All power is electric throughout the entire establishment; it is electrically lighted, the wires passing through conduits, and both hot and cold water is piped to all parts of the building. The washstand for cleaning cars is at the northwest corner of the first floor.

The heating facilities are ideal, the plant being located in a basement compartment on the west side that can only be entered from the outside, and is in reality a fireproof vault. Steam for heating the building is generated by a downdraft boiler. Connected to the boiler room is a 75-ton coal bin.

The gas filling station in front of the garage is equipped with a Bowser 5-gallon pump.

Ford Service Man Tells How Costs are Held Down

Frank W. Lowe Gives New York Association Members Pointers on How They Can Cut Overhead

NEW YORK, April 10—Specializing mechanics as applied to the Ford was the main feature of the April meeting of the Automotive Service Association of New York, held last week at the National Automobile Chamber of Commerce. Frank J. Lowe, Service Manager of the Bronx County Auto Co., was the speaker.

Service managers for other lines of cars had a good laugh at the prices for labor charged under these specializing methods and said "Impossible." However, mirth turned into more serious consideration as Lowe proceeded to explain that these ridiculous times and charges were not on account of any peculiar construction of the Ford car but were made possible by careful study of each and every operation, the almost exclusive use of speed wrenches and the routing and assigning of the work. He convincingly proved that the open end wrench eats up time in the shop.

A great deal of interest was manifested in the burning-in process of fitting engine bearings, it being possible to fit an entire set of connecting rod and main bearings by this process in 30 min. as against 6 or 7 hr. when the operation is done by hand. While so far this process has only been developed for the Ford car, experiments are well under way to adapt it to the Buick, Overland, Dodge and several other cars.

H. S. Hood of the United American Metals Corp. also presented a paper on Babbitt metals and told of the various formulae used, the advisability of buying babbitt on a brand rather than on formula and exhibited some interesting specimens to prove his points. He told of the great number of different kinds of Babbitt in use and said that while each was excellent for the purpose intended, the wrong Babbitt would be a failure if called upon to do work for which it was not intended.

Nineteen new members were elected, bringing the total membership up to 157. It was planned to have an outing in conjunction with the Newark and Brooklyn Service associations.

RESCUE "999" FROM SCRAPHEAP

San Francisco, April 11—An exhibit of unusual interest at the recent automobile show here was the once famous "999" racing car, the champion of the world nearly a generation ago, and the first car to cover a circular track mile in less than a minute. This car was really the first Ford, being designed and built in 1903 by Henry Ford and Harold Wills. Ford secured Barney Oldfield, then a professional cyclist, to drive the car.

On the foundation laid by the 1903 and

1904 campaign of this car, both men rose to fame and fortune. Mr. Ford founded the Ford Motor Co., and became the world's motor king. Mr. Oldfield is now also a manufacturer, being president of the Oldfield Tire Co.

When the Ford-Oldfield partnership was dissolved, in 1905, the old speed chariot drifted to California and lay for many years forgotten in a private garage at Venice. It was discovered and bought by W. L. Hughson, San Francisco sportsman and motor car merchant, who placed it in running order and is using it as a medium of publicity.

As an example of early design, the "999" is unquestionably an interesting exhibit. It has no crankcase, no magneto, no carbureter, no transmission and no differential. Its four immense cylinders dwarf those of modern cars. But it is as fast as ever and, on a straightaway would be able to give an excellent account of itself for from one to five miles, against even the light, handsome speedsters of the present day.

Y. M. C. A. AIDS SERVICE WORK

Chicago, April 11—Assistance to dealers in their service work is being given through the Gary Y. M. C. A. H. C. Polk, secretary of the "Y" in the steel city, is arranging for a series of lectures on the proper care and maintenance of automobiles and has received the hearty support and co-operation of dealers in the city. Gary has more automobiles at present than ever before in its history and servicing these machines is no small task. The dealers believe that an educational campaign along maintenance lines will greatly clarify the situation.

Roy E. Berg, technical editor of *MOTOR AGE*, spoke at the first of these meetings this week. Mr. Berg took as his subject engine construction, and proceeded along the lines of the proper care required to keep the modern internal combustion engine in its best state of efficiency.

BROOKFIELD HOLDS SHOW

Brookfield, Mo., April 11—Brookfield dealers staged their most successful automobile, truck and tractor show here last week. The show extended over a two-day period and drew an attendance of close to 4000 persons. Twenty-five different makes of passenger cars, totaling thirty-five individual models, were shown in the main building, while an exhibition of tractors was staged in a vacant lot across the street from the passenger car building.

EQUIPMENT FIRM INCORPORATED

Hammond, Ind., April 11—The Bruhn Mfg. Co. was incorporated under the laws of Indiana this week for \$95,000. The company manufactures a double eccentric jack for service work. Daniel Bruhn is president of the new corporation, R. L. Hutchinson, vice-president, John M. Stinson, secretary, and M. Sherby, treasurer.

Milwaukee Motor Dealers Reorganize Association

Discard "Automobile" for "Automotive" in Name as Sign of More Comprehensive Policy

MILWAUKEE, Wis., April 8—The Milwaukee Automobile Dealers, Inc., one of the oldest and most energetic local organizations of distributors and dealers in the United States, has effected its reorganization along broader and more comprehensive lines to meet the newer conditions of the automotive age and adopted the new name of Milwaukee Automotive Dealers' association. The work of rebuilding the association has been going on for more than six months and was perfected at the annual meeting last week.

New officers were elected as follows: President, Thomas C. McMillan, vice-president and treasurer Overland Wisconsin Co.; vice-president, M. D. Newald, president M. D. Newald Co., Stewart truck; secretary, Dr. F. W. B. Achen, Cleveland and Chandler; treasurer, Frank J. Edwards, Dodge; directors, Jesse A. Smith, Hudson and Essex; R. C. Chidester, Packard; W. F. Sanger, Franklin; J. C. Millmann, Titan truck; W. H. Upham, Upham-Schacht.

Bart J. Ruddle, who has been secretary and manager of the association since its inception in 1908, was reappointed, with the title of executive secretary under the new form of organization.

Until about a year ago, the M. A. D. was almost purely a passenger car trade organization, excepting in so far as its members handled motor trucks in connection with passenger cars. Then there were admitted exclusively truck distributors and dealers. Under the new policy of organization, the passenger car men will have a distinct organization, while the motor truck men likewise will have their own division, but both will be the composition of the parent association. The adoption of the division plan gives passenger car and truck merchant's greater latitude in matters of mutual business policy. Each will handle its own peculiar problems, and in the general organization deal with affairs that are interrelated.

Like the original association, the new Milwaukee Automotive Dealers' Association will continue to conduct the various Milwaukee-Wisconsin shows, in the Auditorium in January, and at State Fair Park in September. It will also continue an active participation in the good roads movement and exert its best influence for good and against inimical legislation.

ESTABLISH NEW SERVICE PLANT

Philadelphia, April 11—The W. F. Price Storage Battery Co. has moved to more commodious new quarters here, at 1618 N. Broad street. The company handles a complete line of battery parts and service station equipment.

N. A. C. C. to Investigate the Truck Show Problem

Committee Appointed to Take Up Question of Separating Exhibits From Passenger Cars

NEW YORK, April 11—The Motor Truck Committee of the National Automobile Chamber of Commerce has appointed a sub-committee consisting of George M. Graham, general sales manager of the Pierce-Arrow Co. and R. H. Salmonder, vice-president and general manager of the Selden Truck Co. to investigate all phases of the motor truck show question.

A majority of the committee appears to be strongly in favor of holding shows, but expositions of the action type separate from displays of passenger cars as in the past. It is felt that motor trucks should convey the idea of transportation to the last degree and that this cannot be done unless they are shown in action.

While Graham has an open mind on the subject, he is at present in favor of shows held under cover and believes buildings of adequate size to house them should be found. He would have seats provided for spectators where they could sit and watch trucks put through their paces, showing just what could be accomplished in loading and unloading, as well as their manifold uses.

The committee also will take up the number of shows which should be held and their locations. One of the first steps to be taken will be to get in contact with the Motor Truck Sales Managers' association and learn the views of its members.

PLAN OHIO TRUCK TOUR

Columbus, Ohio, April 11—"Motorize the farm" will be the slogan guiding the proposed motor truck demonstration tour to be given throughout central Ohio April 19-24, under the auspices of the Columbus Automobile Trade association. In making the demonstration the primary object will be to show the farmers of the central part of Ohio the uses to which motor trucks can be placed in the operation of farms. It is intended to show how the farmer can get around the marked shortage of farm labor which is confronting him. In all, 15 or more trucks will participate in the tour. While the tour is in progress lectures will be given at various points and on the whole it will be an educational campaign. The tour will be in charge of Frank J. Girard, E. C. Brisley and John A. Howe.

PLAN INTER-CITY CONTEST

Chicago, April 11—Chicago and New York will contest in their second annual inter-city reliability contest in the Chicago district in June this year. Dates have not yet been definitely set for the contest, but it probably will be held June 16 and 17. Indianapolis and Madison, Wis., are favored as the most probable objectives of the runs.

The Chicago-New York contest was inaugurated last year when a team of Chicago motorists went to New York for a three-day run, which ended in a tie score. It is the outgrowth of the Chicago Automobile Club-Chicago Athletic association inter-club runs, originally sponsored by MOTOR AGE and which have been one of the classics of middle western amateur automobile competition. A series of inter-city runs is planned for this year, Milwaukee and Minneapolis enthusiasts both having challenged the Chicago team.

TO BRING OUT NEW CAR

Cincinnati, April 13—F. S. Church, who has been for some time the manager of the Chevrolet retail store in this city, has resigned to devote his energies to a new car of which he is the inventor. The main feature of the new design is the absence of metal springs. Other innovations are four wheel driving, braking and steering, one reduction gear for starting and an estimated speed of 60 m.p.h. The whole car will weigh less than 500 lb. and Church expects to be able to retail it at about \$500.

INCORPORATE TRAINING SCHOOL

Kansas City, April 11—Application for a charter for an automotive training school with branches throughout the middle west was filed here this week. The corporation is to be known as the National Automobile and Tractor Training Corp. and is organized by Guy H. Hall, J. H. McSweeney, C. A. Loomis, G. W. Church and Thomas Shugrue. It is capitalized at \$5,000,000.

Options for sites are held in seven other cities than Kansas City and branches will be established as soon as possible.

TONER QUITS MAXWELL-CHALMERS

Detroit, April 11—Considerable surprise was occasioned in local automobile circles by the resignation of T. J. Toner, sales manager of the Maxwell-Chalmers companies. Mr. Toner had been so long associated with the Maxwell-Chalmers interests that his name came to be almost synonymous with that of the company. No reason has been assigned for his resignation.

NEW SERVICE STATION IN SOUTH HAVEN

South Haven, Mich., April 11—One of the largest service stations and garages in the middle west is to be erected here by local men with Don Hovey as manager. The building will be 100 by 200 ft. and will have storage accommodations for 200 cars, display space for eight and service room for eight cars at a time.

BLOOMER NEW CHICAGO MANAGER

Chicago, April 11—William S. Bloomer has been appointed Chicago manager for the Quaker City Rubber Co. He was for several years with the B. F. Goodrich company and more lately with the Republic Rubber Co.

S. A. E. Men Discuss Fuel At Chicago Meeting

Several Papers Are Read Before Mid-West Section,—N. G. Anderson Tells of Truck Maintenance

CHICAGO, April 10.—Through proper development the large deposits of oil bearing shale can be made a practically invulnerable bulwark of oil supply and that this development would of necessity have to take place should the price of fuel and its output continue to diminish as rapidly as it is doing now, was the statement of John Secor, consulting engineer of the Advance-Rumely Company, at a meeting of the Midwest Section of the Society of Automotive Engineers last night. Mr. Secor addressed the society on the subject of kerosene as a tractor fuel and diverted from his subject just enough to give those present a slight conception of what was in store for the future generations should the supply of petroleum fuel become exhausted. D. Stockfleth and N. G. Anderson, truck engineers of the International Harvester Co., presented jointly a paper on "Truck Maintenance."

An interesting discussion took place on Mr. Secor's paper. Mr. Horning, president of the Waukesha Motor Company, Waukesha, Wis., talked about the fuel problem as it affected the design of the combustion chamber, and alluded to these difficult subjects in a way that only Horning can. During Mr. Horning's talk he said in a half serious and partly humorous way that they had just found out that one factor which governed the successful burning of kerosene fuel was that any surface within the combustion chamber must not be parallel to its opposite surface.

Time limited the discussion on the second paper on "truck maintenance." Mr. Anderson, who presented the paper, asked for a general discussion of the question on the facilitating of truck maintenance effected through design and in this discussion it was pointed out that accessibility was the prime factor that controlled the service cost. L. W. Pietsch, of the Standard Oil Company, responsible for the maintenance of 5800 trucks and 6000 passenger cars throughout the United States, said that he hoped to see that day when the truck would be built so accessible that in the event of an engine breakdown on the road the factory service branch could meet the truck and slip in a new engine. Mr. Pietsch said that this could easily be brought about by placing the engine in skids, so that by undoing a few thumb screws the radiator core could be lifted out and the engine slipped out through the radiator shell. Mr. Pietsch further pointed out the ridiculousness of a design where a high pressure tire pump for truck pneumatics, located on the transmission, could be gotten at only by lifting up the seat and the floor boards should it happen that the air line should blow off from the pump.

Des Moines Truck Dealers in Novel Stunt, Move Herd of Prize Cattle

DES MOINES, Iowa, April 9—Members of the Des Moines Motor Truck Dealers association pulled a mighty good publicity feature this week when they moved the \$150,000 herd of pure bred Jersey cattle belonging to E. T. Meredith, the new Secretary of Agriculture in President Wilson's cabinet. Mr. Meredith wished to move his herd from his farm south of the city to a new dairy farm which he has established about ten miles north and west of Des Moines. Even though the haul was but twenty miles railroad facilities were such that the shortest time the haul could be made in was estimated at eighteen hours.

Managers of the Meredith farm did not care to risk a valuable herd of milch cows on such a long trip in freight cars and appealed to officers of the Truck Dealers' association for assistance. Needless to say the men at the helm of the association fell to the proposal with enthusiasm and quickly arranged for twenty trucks furnished by sixteen dealers to haul the high priced cattle.

Equipped with Farm Bodies

Virtually all the trucks were equipped with farm bodies and the haul gave a striking example of the efficiency of the motor truck for farm work. The cows were milked in the morning as usual, and about 10 o'clock the caravan left the old farm, with Financial Beauty's King, the \$60,000 head of the Meredith herd in the leading truck. The train proceeded into Des Moines. Here moving pictures of the caravan with its high-priced freight were taken by representatives of three or four of the national film companies. Incidentally these films will give no small amount of publicity to the stunt pulled off by the truck dealers.

Then the train started for the new home of the herd and the trucks were back in Des Moines a little after two o'clock in the afternoon. As a result the milkers were given time for a good rest before evening milking.

Lynn P. Townsend, manager of the Meredith farm, is greatly pleased with the results shown by the trucks in transporting the dairy herd. After he had time to see what

effects the trip had had on the herd, Mr. Townsend said: "The cattle came through in the best possible condition. There was not a single injury of any kind and there was no appreciable falling off in the amount of milk for even a single milking. When we compare this fortunate situation with what would have prevailed had we been compelled to ship by train we are doubly pleased."

CASE BUILDS IN INDIANAPOLIS

Indianapolis, April 10—The J. I. Case Plow Works will erect a new \$100,000 building in Indianapolis for the housing of its product. This announcement was made at a conference at the Severin hotel of the company officials.

The conference which will affect the entire Indianapolis territory was called to work out extensive plans for the development of the Wallis tractor and Case Implement lines. The meeting was presided over by Charles C. Younggreen, advertising manager of the J. I. Case Plow Works. The company in Indianapolis has been occupying leased warehouses.

APPROVE MILWAUKEE TRUCK RUN

Milwaukee, Wis., April 8—The Milwaukee Automotive Dealers' association has given its approval of the motor truck tour which will be conducted in Wisconsin from June 21 to 26 under the auspices of the Milwaukee Sentinel, a leading daily newspaper which promoted the principal passenger car reliability tours in this state years ago. Alfred Reeke, Nash dealer, and chairman of the transportation committee of the Milwaukee Association of Commerce, has been

appointed chairman of the general committee in charge of the tour. Frank A. Meyer, city sales manager of the Sterling Motor Truck Co., Milwaukee, will act as tour master. Further details will be given later.

OFFER NEW RADIATOR SERVICE

Buffalo, April 8—Something new in the way of radiator service has been placed at the command of Buffalo motorists by United Motor Service, which is now rendering factory service in the repairing of radiators. In order to equip itself to do this work, it obtained, according to F. L. Willcox, manager of its Buffalo branch, complete radiator core data from the country's leading motor car manufacturers, and with such information in hand made up templates for all sized cores used on all models from 1912 to date. The possession of these templates and standard core sizes enables it to carry on hand a sufficient amount of core stock to replace the core on practically any automobile in use. United Motor Service represents the Harrison Radiator Corp. of Lockport, nationally in rendering factory service, but the service outlined in the foregoing is not limited to radiators made by the Harrison concern.

The service referred to above has also been established by United Motor Service in New York, Philadelphia, Boston and Toronto, and will be extended to other cities in this country and in Canada.

NO FACTORY FOR BOULEVARD

Indianapolis, Ind., April 10—Aiming at the Craig-Hunt Motors Co., which proposed to erect a manufacturing plant at Meridian street and Maple Road Boulevard, two of Indianapolis' boulevards, the Board of Park Commissioners, controlling the administration of the boulevards, has passed an order prohibiting "horse racing, gambling, offensive or dangerous business" within 500 feet of any of the city's boulevards in an effort to prevent the commercialization of residence districts under the jurisdiction of the board.

Automobile concerns, notably the retail district on Meridian street, have made severe industrial encroachments on the boulevards and when the Craig-Hunt Motors Co. announced its plan to erect a factory and service station at the junction of the two boulevards in the heart of the city's most fashionable residence district, there was a general civic protest.



Denver has under consideration an ordinance which would bar horses from the city streets. Perhaps we may see this sort of thing if the Denver law is passed and if other cities adopt the plan

The Craig-Hunt Motors Co. has issued a public statement pointing out the locations of other companies on the boulevards, all without protest, and asks why discriminate against their company. The city has become alive to these encroachments and for the preservation of the future city beautiful, the park board has decided that industrial concerns cannot invade the residence districts.

ORGANIZE NEW TRUCK BODY

Mansfield, O., April 11—The Richland Automotive Trade association, composed of dealers, garagemen, repair shop proprietors and tire and accessories dealers has been organized, covering the county of Richland. The charter membership list will be kept open until April 13 when it is believed that more than fifty will have joined the association. Officers have been elected as follows: F. A. Brown, president; Archie May, vice president; R. D. Stewart, secretary and George Frietcher, treasurer. The association has been affiliated with the Ohio Automobile Trade association.

TO TRAIN FOR TRACTOR SERVICE

Kansas City, Mo., April 3—The National Automobile and Tractor Training Corporation has been organized in Kansas City, with Guy H. Hall as president, a \$5,000,000 corporation which will go at the matter of training men for tractor service and operation.

The purpose is to establish courses somewhat shorter than those now given in agricultural colleges, but with some of the valuable features of such college courses; and somewhat longer than the usual commercial training school course, but with the valuable features of those courses. Branches are to be established in several other towns. Mr. Hall is widely known as the manager of the National Tractor show at Kansas City for the past five years, and as secretary of the Kansas City Tractor club. The vice-president and general manager of the school is J. H. McSweeney.

New Section of Columbia River Highway Nearing Completion

PORTLAND, Ore., April 12—Much has been written regarding the wonders of the Columbia River Highway in Oregon, which extends from Portland up and down the Columbia river, but the half of it has hardly been told, for now a new section of this highway is being completed through scenery equal to or surpassing in grandeur that along the finished portions of the drive. An extension of the present upper highway is under construction from Hood river to The Dalles, approximately twenty-five miles, the new highway grade being mostly along the tops or hewn out of the sides of the cliffs of the Columbia river gorge.

Between Hood river, the apple center, and Mosier the new highway grade comprises the heaviest piece of construction work ever let by the Oregon State highway department, which is saying a good deal. The grading alone of this 6.3 mile section has cost approximately \$580,000.

At one point it bores through two tunnels, one of which is 272 ft. long and nearly 300 ft. above the river. This tunnel will have two rock windows through which motorists may peer at the river below, or at the rock cliffs on the state of Washington side, a mile away.

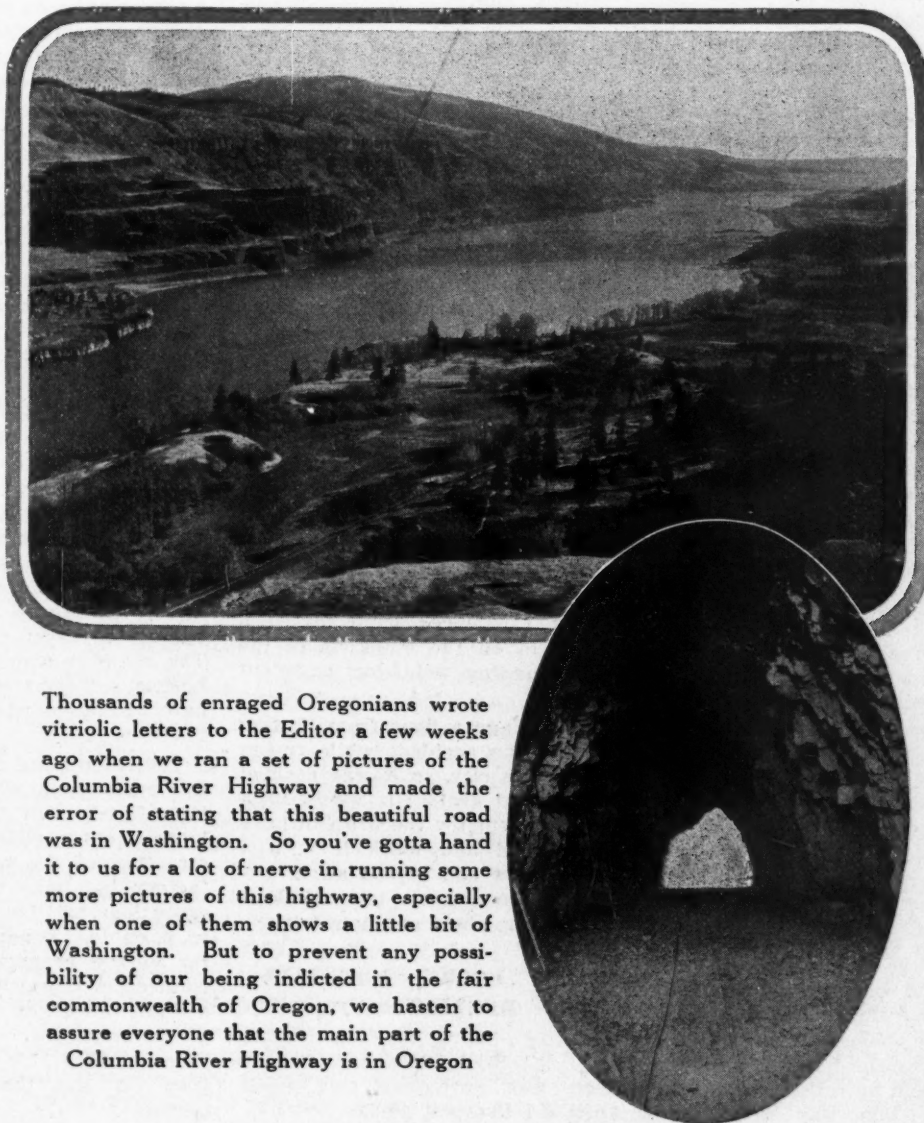
When this new Hood river-The Dalles section of the highway is completed this year and paved next year, it will complete an all-scenic, hard-surfaced drive nearly 100 miles long from Portland east up the Columbia river. In the other direction the lower Columbia river highway extends west from Portland to Astoria and the sea, a little more than 100 miles. It, too, is scenic and will be completely paved by the end of this season.

FORD MEN MEET IN LOS ANGELES

Los Angeles, April 12—Ford dealers of Southern California, Arizona and Southern Nevada are holding their annual convention here. Announcement was made that bodies for the Pacific coast supply of Ford cars are to be made in the local plant, beginning soon. The assembly of cars here was discontinued some time ago. Chasses are to be built exclusively at the San Francisco plant.

Ford business has grown from \$500,000 in 1912 to \$4,000,000, according to what B. L. Graves, local manager, told the dealers.

C. A. Brownell, advertising director for the company, told of the widespread publicity now being accorded Ford products. He said the company will build 1,500,000 cars this year unless unforeseen difficulties should arise. He also said that if the manufacture of cars were discontinued entirely the company could pay an 8 per cent annual dividend on its stock by operating the parts business alone.



Thousands of enraged Oregonians wrote vitriolic letters to the Editor a few weeks ago when we ran a set of pictures of the Columbia River Highway and made the error of stating that this beautiful road was in Washington. So you've gotta hand it to us for a lot of nerve in running some more pictures of this highway, especially when one of them shows a little bit of Washington. But to prevent any possibility of our being indicted in the fair commonwealth of Oregon, we hasten to assure everyone that the main part of the Columbia River Highway is in Oregon

Plan for Exclusive Truck Show for Cincinnati

Ohio Dealers Also Working On Plan to Stabilize Market For Used Commercial Cars

CINCINNATI, O., April 10—An exclusive motor truck show, to be staged probably this spring, and a centralized sales agency for the appraisal and sale of all used trucks taken in exchange for new trucks, are among the first aims of the newly organized Cincinnati Truck Dealers' association, which comprises in its charter membership the leading truck manufacturing and sales organizations of this territory.

The motor truck show will likely be held at Music Hall. The advisability of staging it on the lavish scale that the large floor space of Music Hall will permit is now under consideration by a committee composed of William M. Kilduff, Harry P. Kelley, L. A. Woodward, Albert Hoffman, Albert Staab and E. L. Scott. The date will be announced in a few days.

The association has made a contract with the Cincinnati Motor Truck Exchange to handle second-hand and used trucks taken in exchange for new trucks by members of the association. The exchange will appraise these trucks and offer them for sale in a centrally located appraising and sales station. Several sites for this station are now under consideration and negotiations will be closed so that this service can be started soon.

The association has appointed Harry K. Shockley, Provident Bank building, as its manager and its affairs will be conducted through Mr. Shockley's office. Mr. Shockley is business manager of the Greater Cincinnati Amateur Commission but has long been identified with the automobile industry in this city.

Charles B. Ratterman is president of the new truck dealers organization. William M. Kilduff is vice president; Harry P. Kelley, treasurer, and E. L. Scott, secretary.

QUINCY DEALERS SUBDIVIDE

Quincy, Ill., April 9—Members of the Quincy Automobile Trades association are agitating the formation of separate bureaus for each branch of the automotive business, such as passenger cars, trucks, tractors and accessories. This will simplify the work of the association and enable the officials to render more efficient service to the trade.

DES MOINES DEALERS REORGANIZE

Des Moines, Iowa, April 9—With the reorganization affected at the recent annual meeting the Des Moines Truck Dealers' association is counting on the most active year in 1920 that it has ever had. Under the new order of things each director will be at the head of an important committee and by centralizing the responsibility in this way it is

thought concrete results can be gained in a more effective way. The directors and the lines of work over which they will preside are Don Chamberlain, Tours; L. B. Chase, Trade Practices; Advertising and Publicity, E. E. Stacey; Finances and Legislation, A. M. Brackett; Shows and Expositions, William Gibson; Meetings and Programs, L. A. Doren.

Carter B. Hull, who has been president of the association for the past three years, will inaugurate a series of monthly dinners for the association and well-known men in the trade will be brought to Des Moines to speak at these dinners on truck merchandising.

The association is making plans for the truck show to be held in connection with the Iowa State fair late in August, and also plans for tours during the season.

CONTEST IN ST. LOUIS ELECTION

St. Louis, April 8—Two tickets have been placed in nomination for the annual election of officers of the St. Louis Automobile Manufacturers' and Dealers' association, which will be held next Monday evening, as follows:

For president, P. H. Brockman, DeLuxe Automobile Co.; H. F. Fahrenkrog, Kardell Motor Car Co.

For vice-president, George Weber, Weber Implement and Automobile Co.; Frank R. Tate, Tate-Gillham Motor Car Co.

For treasurer, W. L. Johnson, Johnson Automobile Co.; E. A. Hatfield, Mississippi Valley Motor Co.

For directors (six to be elected), L. H. Amrine, Scudder Motor Truck Co.; C. A. Aldrich, Aldrich-Stephens Motor Car Co.; John Boe, St. Louis Motor Car Co.; Webster Colburn, Dorris Motor Car Co.; R. C. Frampton, Hudson-Frampton Motor Car Co.; H. G. Hurd, Buick retailer; J. D. P. Lewis, Lewis Automobile Co.; A. G. Ross, Franklin-Ross Automobile Co.; I. S. Salisbury, More Automobile Co.; Joseph A. Schlecht, Mound City Auto Co.; H. L. Schnure, Velie Automobile Co.; H. W. Spalding, Chevrolet Motor Co.

KANSAS DEALERS BUY AIR FIELD

Emporia, Kan., April 9—Motor car dealers in conjunction with the local Chamber of Commerce have leased a forty-acre field on the outskirts of the city for a landing field for transient aviators.

Several days ago a flyer from Kansas City met with an accident while trying to land near the city, so it was decided by the interested dealers it would be a good advertisement for the town to have an aviation field and mark it with a large white cross and extend an invitation broadcast to aviators to make Emporia a stopping place on their trips.

POSTPONE ROCKY MOUNTAIN MEETING

Pueblo, Colo., April 11—The Pueblo meeting of the Rocky Mountain Trades association was postponed this week from April 6-7 to April 20-21.

Wisconsin Men Want New Show Building for Trucks

Would Erect Structure to Be Used for Exclusive Merchandising of Commercial Vehicles

MILWAUKEE, Wis., April 8—Action toward the erection of another large exposition building at State Fair Park, West Allis, for the accommodation of the motor truck merchandising trade in a manner similar to that already provided for the passenger car trade, has been taken by the Wisconsin state authorities.

The State Department of Agriculture, which directs the annual state fair, has granted permission to the motor truck division of the Milwaukee Automotive Dealers' association to erect a building about 100 by 400 ft., costing \$60,000 to \$75,000, which will be situated near the present Motor Hall building, of approximately equal size, erected about five years ago for the use of the Milwaukee distributors and dealers. At first the existing building afforded sufficient room to handle both passenger and commercial car exhibits, but in the last three years it was necessary to provide a large circus tent as an annex to handle trucks, the permanent structure being adequate only for passenger car and automotive equipment displays.

The Milwaukee Dealers' association has been desirous of erecting another building for several years, but the intervention of war prevented action until now. The permission granted by the State Department of Agriculture lets the matter rest entirely with the dealers to finance, erect and equip the exposition hall. It is hoped to have it ready by the time of the next state fair, to be held August 30 to September 4.

WILLYS TAKES OLD ALLEN PLANT

Fostoria, O., April 9—The former plant of the Allen Motor Co. at Fostoria, Ohio, has been taken over by the Willys Corp., and will be operated in the production of farm lighting plants. The Chamber of Commerce at Fostoria as an inducement to the Willys Corp. agreed to pave the street leading to the property and to operate a street car line to the plant. The chamber also guaranteed to furnish houses sufficient to care for the many new residents, who will be brought to Fostoria.

The Allen plant and site includes fifty-five acres upon which the Willys Corp. immediately will begin the erection of large factory additions. Pending construction of the additions, the present factory buildings will be equipped and operations will begin in them as quickly as possible. Negotiations for the transfer of the property and all details in connection therewith were concluded at a dinner given by the Fostoria Chamber of Commerce, at which officials of the Electric Auto Lite Co., the Willys-Overland Co. and the Willys Corp. were guests.

Carolina Exhibit Opens This Week at Raleigh

Extensive Plans Are Made For Big Automobile Display Staged By Southern Dealers

WILMINGTON, N. C., April 10—From all reports no automobile show has ever been conducted on so large a scale in North Carolina as the Carolina Automotive Exposition to be held in Raleigh during the week of April 12 to 17. The privilege of exhibiting has not been confined to Raleigh dealers, but South Carolina, Virginia and Georgia as well will display their trucks, cars, tractors and accessories at the Raleigh event.

Cities represented in the contracts are Raleigh, Charlotte, Asheville, Greensboro, Durham, Oxford, Wilson, Tarboro, Lumberton, Atlanta, Columbia, Richmond, Norfolk and Philadelphia, and Toledo and New York. Other states are expected to ask for allotments at the last minute.

The big tent which will house the exposition has been put in place, and interior work will transform the canvas hall into a beautiful floral conservatory. Decorations will consist principally of palms, twining vines, flowers and attractive electrical effects.

In presenting a motor event for dealers and automobile enthusiasts, the chamber of commerce has not forgotten extra features. Entertainment parts of the exposition will be one of the most elaborate that could be secured for undertakings of this nature. The week's program will be largely musical, and to make such a success the management has booked Pat Conway's Band, with its instrumental soloists and three singers.

The week will have its social features also. In addition to big dances throughout the period of the exposition, different dealers have arranged to give special stag parties, dinner outings and other forms of entertainment.

DESIGNATE INDIANA STATE ROADS

Indianapolis, April 10—Roads constituting the state highway system have been designated by the Indiana Highway Commission in an official statement. There are forty-nine routes in the state system, including approximately 3,200 miles, not including 200 miles of village and city streets, constituting parts of the actual system. The commission will begin at once to maintain this system.

The routes are so arranged as to connect each county seat in the state with seats of adjoining counties and to furnish the state highways crossing at strategical points in all directions, connecting with routes in adjoining states.

WILMINGTON SHOW IS OPENED

Wilmington, N. C., April 10—Wilmington's first automobile show and industrial exhibit was officially opened Tuesday night, and at the same time the new city auditorium was officially dedicated.

The occasion marks what the Chamber of Commerce hopes will be an annual classic. The dedicatory ceremony consisted of a short address by Mayor Parker Quince Moore, which was followed by a concert by the Royal Scotch Highlanders' Band, a musical attraction extraordinary which had been engaged for the week.

The decorators had converted the auditorium into a picturesque and patriotic spectacle, and one that provided a handsome setting for the huge display of automobiles upon the first floor. The industrial exhibit was housed upon the second floor.

Automobile concerns in North and South Carolina and Virginia engaged space for exhibits at the show, in addition to a number of the larger manufacturers. Every class of vehicle in the automotive industry was on display during the week.

FIGHT AGAINST CITY CAR TAX

Wilmington, Del., April 5—The Delaware Automobile association has launched a vigorous assault upon a bill which has been introduced in the Legislature authorizing the City Council of Wilmington to impose a municipal tax on motor cars. As a matter of fact, the bill authorizes the Council to tax cars "operated in the city," which means that those of outsiders could be taxed, if the bill passed, the minute they get within the city limits. In this particular, at least, the bill is manifestly unfair, while the association claims that the state tax, already higher than in many other states, is enough. The association favored the bill imposing the present state tax, with the understanding that there should be no other tax, that communities could not add to the burden. Hence its disposition to treat the present move as a breach of faith on the part of the state.

Should the bill pass, Charles G. Guyer, secretary of the association points out, the reciprocal relations with other states would be jeopardized, as all cars coming into the city would be liable for the tax, whether owned here or not. The city, it is understood, contemplates, if given the proper authority, to impose a tax of \$5 a car, which would net probably \$40,000 this year.

TRUCK SALES OVER \$227,000,000

Washington, April 12—Motor truck sales during the last six months of 1919 totalled \$227,695,328, according to Internal Revenue reports, which in that period amount to \$6,830,859.84 as a result of the 3 per cent tax on motor truck sales, according to information just made public by the Internal Revenue Bureau. Passenger car and motorcycle sales during the same period were registered at \$698,895,991, which resulted in a Government revenue of \$34,944,799.55, based on the 5 per cent tax. At the same time tires, parts and accessories taxed at 5 per cent yielded \$25,825,118.57 to the Government, indicating sales amounting to \$516,542,371.40.

Cincinnati Wants One of National Tractor Displays

Ohio Dealers Start Movement to Land Exhibit,—Show State's Agricultural Importance

CINCINNATI, O., April 15—Plans for bringing to Cincinnati one of four national tractor shows to be given in the winter of 1920-21 under auspices of the tractor division of the National Implement and Vehicle association, were launched here to-day by twenty-two representatives of the tractor manufacturing and allied industries from fourteen cities of Ohio, Indiana and Kentucky.

At a dinner given at the Chamber of Commerce, these representatives formed a temporary organization of a Central States Tractor and Implement association and appointed a committee to work out the details of a permanent organization, which will be perfected at a meeting to be held within the next thirty days at some centrally located city. On the committee are George Hills, general manager of a tractor company at Greenville, Ohio, and Thomas Quinlan and W. G. Welborne, of Cincinnati.

A vigorous campaign will be made by the association to bring the Middle West show to Cincinnati. Cities represented in the association are Cincinnati, Columbus, Toledo, Portsmouth, Upper Sandusky, Greenville, Shelby and Canton, Ohio; Lafayette, Evansville, Anderson and Indianapolis, Ind., and Louisville, Ky.

DISCUSS MOTOR INSURANCE

Columbus, O., April 11—A meeting of local underwriters and leaders in motor truck transportation in Ohio was held in Columbus recently to get together on the question of cargo insurance at reasonable rates to help along the motor transportation business. Restrictions in policies now issued are a handicap to the development of the service and steps have been taken to have the policies rewritten.

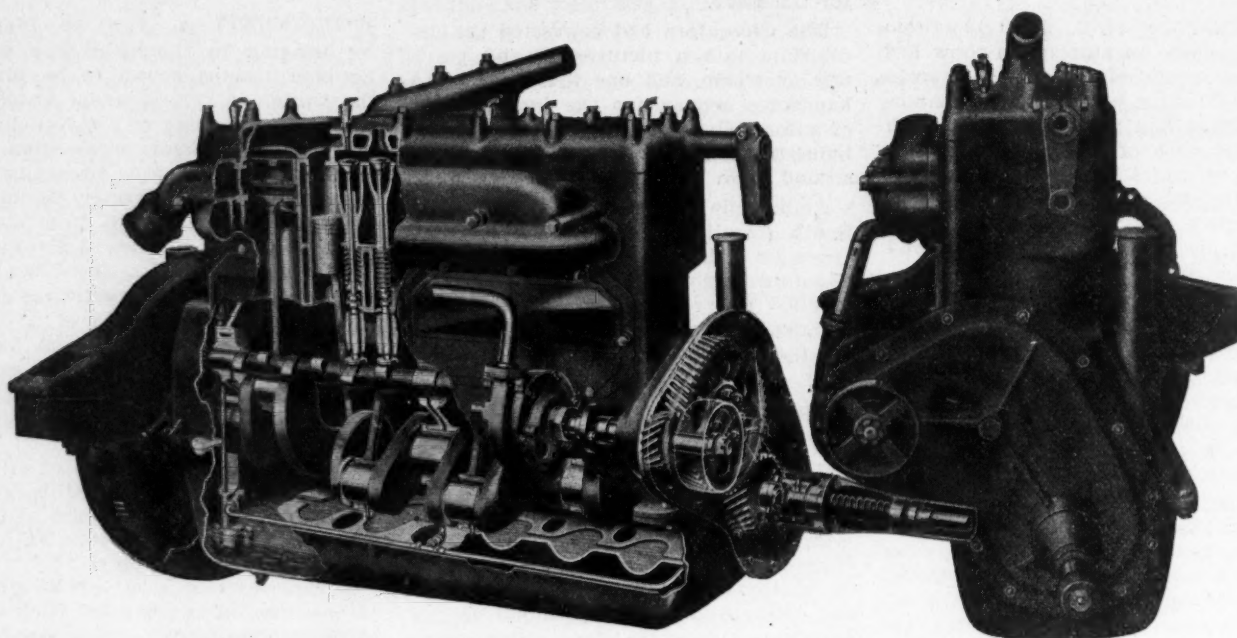
CALIFORNIA REVIVES "VIGILANTES"

Los Angeles, Calif., March 28—Revival of the old "vigilante" days of California is planned by the Automobile Club of Southern California, to prevent motor car accidents and theft. A vigilance committee of 200 prominent business men is being formed who will always be on the job and act secretly. Each will be pledged to report all infractions of the traffic laws observed by him, promptly, by mail, on post cards furnished for that purpose. Machines will be traced by license number only.

Organized action has been made imperative by the rapid increase of motor vehicles in the city. California now is credited with more automobiles per capita than any other state, with one to every six inhabitants, and in Los Angeles county alone there are one-third of the total number in the state,—there are more than 141,000 in this one county.

Two New Engine Designs by Herschell-Spillman

Four Cylinder Develops 35 Hp. at 1900 R.P.M. and Six Cylinder 58 Hp. at 2000 R.P.M.



A sectional view of the new Herschell-Spillman engine is shown above. Note that a gear driven geared oil pump forces the oil to the bearings. The front view of the engine shows its clean cut design

THE Herschell-Spillman Motor Co., which has long been active in the gasoline engine field, has recently developed two new designs in line with present day requirements of automobile manufacturers. One is a four-cylinder engine of 192.4 cu. in. piston displacement, developing 35 hp. at about 1900 r.p.m. and the other a six of 248 cu. in. piston displacement, developing 58 hp. at about 2000 r.p.m. Both engines have all of the cylinders and the top half of the crankcase cast in a single block and use a pressed steel lower half. The form is built for thermo-siphon circulation while the six is fitted with a centrifugal circulating pump.

The four-cylinder model has a bore of $3\frac{1}{2}$ in. and a stroke of 5 in., giving a piston displacement of 192.4 cu. in. A horsepower curve published by the company shows a peak load of 35.5 hp. at 1900 r.p.m. This output was obtained with the following equipment: $1\frac{1}{4}$ in. Zenith carbureter, Bosch magneto and A. C. spark plugs. The compression volume is 21 per cent of the combined piston displacement and clearance volume.

Three Point Engine Support

The engine is designed for three point support, having two supporting arms cast integral with the flywheel bell housing and the third supporting member in the form of a trunion on the cam gear housing concentric with the crankshaft.

Pistons are made of cast iron, $3\frac{3}{4}$ in. long and fitted with three rings $\frac{3}{16}$ in.

wide each. Connecting rods are I section drop forgings measuring 11 in. between centers. The piston pins are of the usual hollow case-hardened type, $\frac{7}{8} \times 3\frac{1}{4}$ in., fastened in the piston bosses and journaled in phosphor bronze bushes in the upper end of the connecting rods, which brushes are $\frac{17}{16}$ in. long. The crankshaft is 2 in. in diameter both on the crankpins and the main journals, the former being 2 in. long and the latter (of which there are two) 4 in. There are three bearings on the camshaft of the following dimensions (front to rear): $2\frac{1}{8} \times 2\frac{1}{2}$ in., $2\frac{1}{2} \times 7\frac{1}{2}$ in., $1\frac{1}{2} \times 2\frac{1}{2}$ in. Between bearings the camshaft has a diameter of $1\frac{1}{8}$ in. All bearings on the crankshaft are of the bronze back, babbitt-lined type. The camshaft drive is by helical gears of 9 diameter pitch by $1\frac{1}{2}$ in. width of face.

The valves have a clear diameter of $1\frac{1}{8}$ in. and a lift of $\frac{1}{2}$ in. They are operated by means of push rods with mushroom type cam followers and screw and check-nut adjustment for clearance. An interesting feature is the arrangement of the push-rod guides which tends to easy production. These guides are cast integral with plates bolted to the side of the engine over the valve stem compartment. There is a hand hole in each of these plates which is closed by a pressed steel plate.

There is a $1\frac{1}{4}$ in. carbureter boss at the side of the engine opposite the valves, suited to an S. A. E. standard side outlet carbureter. In view of the use of thermo-siphon circulation, the

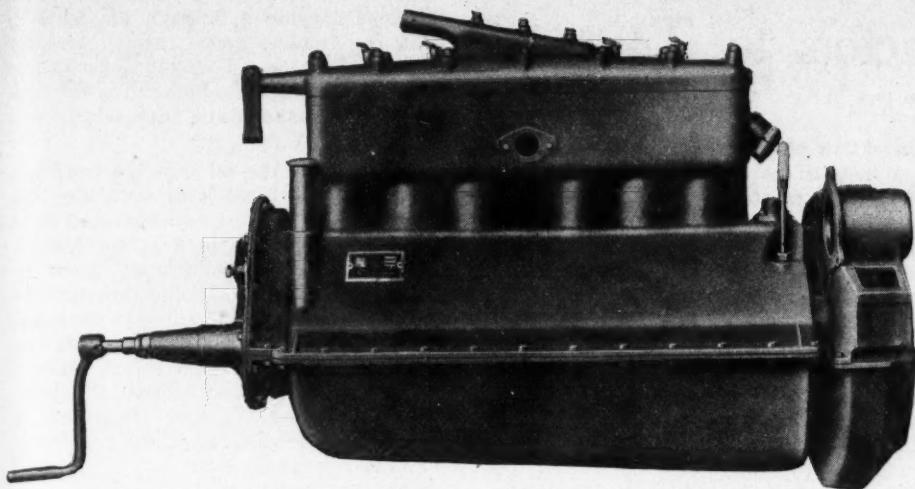
water connections are very large—2 in. in diameter. A combined inlet and exhaust manifold is fitted which is bored for a 2 in. outside diameter exhaust pipe.

Lubrication is by a combined force feed and splash system. To the crankshaft main bearings and the end bearings of the camshaft the oil is forced under pressure by the gear type, gear-driven pump, and there is direct feed to the gear housing. All other bearing surfaces are lubricated by splash.

The fan bracket is of the cranked type, is supported by the cylinder head and permits of making adjustments of the belt tension. The flywheel weighs 55 lbs. and has the starter gear cut on it, consisting of 138 teeth of 8-10 pitch. Either a No. 3 or a No. 5 S. A. E. bell housing can be furnished, with a No. 2 starting motor mounting flange. The former bell housing is suitable for the outboard and the latter for the inboard Bendix drive. The weight of the engine is 440 lbs.

58 Hp. at 2050 R.P.M.

The six cylinder engine has $3\frac{1}{4} \times 5$ in. cylinders. It develops a maximum of 58 hp. at 2050 r.p.m.; fitted with a Zenith $1\frac{1}{4}$ in. carbureter, Bosch magneto, variable spark and A. C. plugs. The compression volume is 21 per cent. Valves are of $1\frac{1}{8}$ in. clear diameter by $\frac{1}{2}$ in. lift. A similarity in the dimensions of the six and four-cylinder engines is noticeable, which is an advantage from the manufacturing as well as the service viewpoint. Thus the crankpin bearings,



The left of the Herschell-Spillman engine is perfectly free from auxiliaries, with the exception of the starting motor which is mounted on the flywheel housing

the piston pin bearings and the camshaft bearings are the same size on both models. The six throw crankshaft has three main bearings, of 2½ in. outside diameter and 2¼ in. bore, the lengths being 3, 2½ and 4 in., front, intermediate and rear, respectively. The same connecting rod is used as in the four cylinder engines.

Pistons are 3¼ in. long and have three ⅝ in. rings. Cooling is by centrifugal pump with 1¼ in. o.d. water inlet to the cylinder block and 1½ in. outlet. Lubrication is the same as on the four. The flywheel is cut with 138 teeth of 8-10 pitch (17.25 in. pitch diameter) and is enclosed in an S. A. E. No. 3 bell housing.

The weight of the six-cylinder engines is 563 lb.

A Plea for Rust-Proof Nickel Trimmings

Editor, MOTOR AGE—I believe that buyers and users of the better class of automobiles should insist that all conspicuous bright parts about a car—the fittings and screws of the instrument board, lamp rings, etc.—should be of non-corrodible metal, whether nickeled or not, and that the makers should recognize the justice of the demand and meet it fairly.

I am having my car overhauled and refinished after a season's use. It is a standard high-grade touring car of good reputation and performance, and the mechanism is in thoroughly first-class condition, but I find that many of the bright parts have rusted underneath the nickel and must be replated. Inspection of other cars which have seen an equal, or even less amount of service shows the same condition.

Car design is crystalizing to a standard and people now buy with the idea of using a car through several seasons. If the working metal parts can meet this requirement, it seems as though the finished metal parts should do as well. The extra cost of aluminum and aluminum alloys does not deter engine builders from using these materials for comparatively heavy parts, and for bright-finished small parts, where appearance counts, there seems no good reason why some non-corrodible alloy of aluminum or nickel should not be used.

Nickel-Plating Is Porous

Nickel, as deposited in electro-plating, is porous and, on steel, gives little or no protection against rust. It thus becomes necessary in good work to first give this metal a protective plating of copper. The pieces are rough polished, then copper-plated, buffed, nickeled, and buffed bright. If too thin a deposit of copper is made or too much removed in the buffing process and the piece is subjected to the weather as in motor car conditions, it will in a short time commence to rust under the plating. The only remedy is to repeat, and re-repeat, the process,

It is a notorious fact that the nickeled trimmings on the car do not last very long, except where a non-corrodible metal is used beneath the nickeled surface. The communication herewith is from a car owner, but our dealer readers have no doubt felt at times that such an expression would not be out of place, especially when it becomes necessary to re-nickle plate most of the trimmings before selling it as a used car

It is not the re-nickeling itself that counts, but the disconnecting, removing, taking apart, possibility of damage in the operations, loss of, or damage to, loose parts, the alteration in size where a fit is required, the reassembling with possible loss of adjustment, replacement and reconnecting. At present shop prices the cost of doing this work would go a long way toward providing solid silver as a material for the parts—and silver is high now.

Non-Corrodible Alloy

As a material for bright-finished small parts the higher first cost of a non-corrodible alloy over steel is negligible in any single piece, and could not be large in the aggregate. In part, the extra cost would be compensated by the saving in wear on dies and cutting tools, the elimination of several operations in the plating room, and by the saving of time in assembling where a fit was required. The varying thickness of the plating itself in nickeled work makes exact fitting almost impossible.

Altogether, there is so much to favor the use of non-corrodible metal for the bright-work on a car, where it is more or less exposed to the weather, that the higher cost of the raw material need not be seriously considered. Nearly any well-informed motorist would feel it a privilege to pay more for the better material.

The wind-shield frame is another place that develops rust quickly and detracts

from the appearance of a car. There seems to be a movement of the glass in the frame, caused either by strain or vibration or by the effect of different temperatures, which breaks away the enamel at the edges of the joints, lets water in, and rust results. This, in forming, loosens more enamel and the process is repeated, chipping out a constantly enlarging surface. In this case it seems to me that the metal should be thoroughly rust-proofed before being enamelled.—Cooper Hughes, Des Moines, Iowa.

Steiner Hydrokit

The Steiner Hydrokit shown in the illustration is an accurate, non-breakable hydrometer, self-cleaning, reliable and convenient. The secret of keeping a storage battery in good condition is to give an ample supply of distilled water regularly. This device also combines a distilled water container. Manufactured by the Steiner Mfg. Co., Long Island City, N. Y., and sells for \$2.50.



Thousands of Tractors to Texas

(Continued from page 9)

500 old line implement dealers to sell 600 tractors for one of the old line concerns, and if upon the other hand, it takes only fifty-six dealers, twenty of whom are exclusive, to sell an equal number of tractors for one of the newer concerns, then it begins to look as if there might be some chance for the late comers to make at least a qualified success. The instance cited is not hypothetical, but actual.

The significant thing about these new concerns is that each is building up a complete line of power equipment only. Each avers it as its intention to give the dealer every item he may need for the complete motorization of the farm and to prove to the said dealer that it will pay him to concentrate his efforts on that line exclusively. To an outsider it looks as though the new type of dealer will be very apt to loosen that half Nelson the implement dealer has had so long on the Texas tractor trade.

Corn and cotton—think what that means. Row crops. Go miles and miles through the black belt and see how row crops predominate. The ground is plowed in the spring for both corn and cotton. Very similar machines are used for planting both products. The period and manner of cultivation is almost the same for both. They separate only when it comes to the harvest. What does this mean?

It means a tremendous demand for a general purpose tractor and for the motor cultivator. Both types of machines will have a tremendous sale in Texas. One El Paso dealer sold 110 motor cultivators last year. Dealers are buying them all through the black belt by the scores. Every concern coming into the tractor business regards the motor cultivator as an absolutely necessary part of its motorized line.

I mentioned seeing many tractors at work between Dallas and Waco. There were Avery, Case, International, Fordson and others, but I was particularly impressed by the number of Molines I saw. The sight was a practical dem-

onstration of what every wholesaler and dealer told me about the coming popularity of a tractor of the universal type. One hardly can believe otherwise when one sees the extent to which row crops dominate the landscape.

The only question is, will the present type of tractor negotiate the gumbo soil conditions of the black belt and be powerful enough to do the work required of it? The type is being tried out everywhere and in every form. The Indiana, for instance, is breaking into the trade by the way of Ft. Worth; the Moline branch houses are not letting the interests of the Moline suffer; every motor cultivator is on the ground and is being pushed and the other tractors of universal type that are made are seeking recognition. There are those who say that a new and different tractor will be developed. There are those who maintain that the present tractors will fill the bill. Only time will tell.

Completely motorized farm are going to be very numerous in Texas in the very near future. In addition to tractors and motor cultivators the farmers are beginning to buy motor trucks. One and 1½-ton trucks are the most popular. Truck dealers are anticipating an enormous increase in the demand from the farm during the next two or three years.

to allow the same proportionate amount of clearance because aluminum is a much better heat conductor than iron. With aluminum the clearances are obtained according to the rule which is printed on the piston shown in the illustration.

Assuming that one has a 3 in. bore, the proper clearances for aluminum piston would be obtained as follows: The clearance at the skirt of the piston would be 3x0.0015 or the piston skirt would be smaller than the cylinder bore by 0.0045 in. Exactly, the piston would measure 2.9955 in. The first ring land above the skirt would be smaller than this figure by 0.001 in. and the other measurements would correspond to the rule shown in the illustration. This clearance is slightly larger than that which was printed in MOTOR AGE recently, as being the recommended clearance used by a certain dealer.

Piston Clearance for Iron and Aluminum Pistons

(Concluded from page 19)

The first ring land immediately above the skirt should measure 0.0005 in. less than the skirt diameter. The next ring land should be smaller than the preceding ring land by 0.0005 in., or it will be smaller than the skirt of the piston by 0.001 in. The top land of the piston should be smaller than the skirt by 0.002 in. or smaller than the the preceding ring land by 0.001 in. These clearances are very successful for iron pistons.

For aluminum the clearance should be greater. Aluminum expands about twice as much as iron. But it is not necessary

New Type Engine Bearing

(Concluded from page 21)

of a small shaft, let us take as an example. An engine with a 3 in. operating 1800 r.p.m. has a shaft velocity of 141.5 ft. per min., which means that a point on the shaft travels that far in one minute. Now, with a shaft one-half the size of the one mentioned, the bearing velocity will be about 71 ft. per min. The interpretation of these results shows that there is twice the rubbing surface with the large shaft and consequently twice

the heat developed through the friction. With the Babbitt metal thrown forcibly into the backing an absolute assurance is obtained that the conduction of heat through the Babbitt and the backing will result.

To introduce the oil into the bearings, when they are fitted with such absolute accuracy, can not be accomplished with any low pressure splash oiling system. Extremely high pressure oil must be used, and this is forced through the drilled passages in the shaft to the bearings. Under full load a well known six-cylinder engine has something like 7 gallons of oil forced through the shaft every minute. A study of the action of this oil as it flows through the bearing is very interesting.

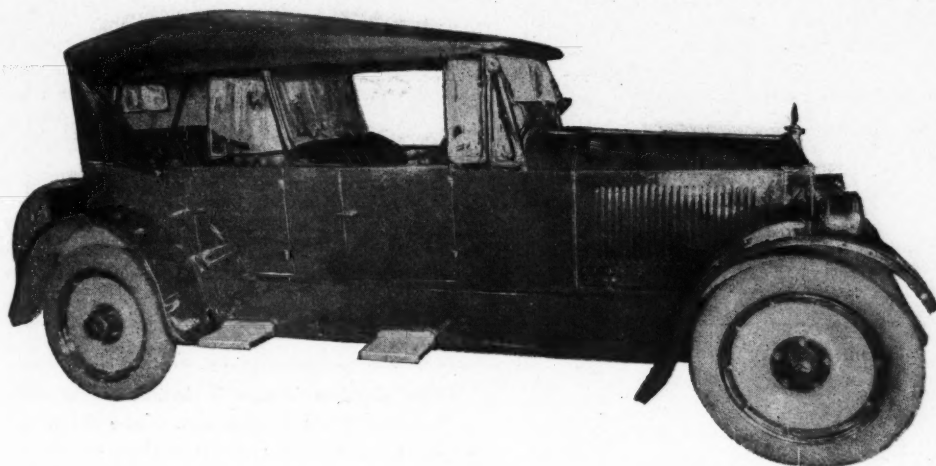
The oil must of necessity flow through the bearing in a thin film. The thickness of the film is dependent upon the clearance of the journal in the bearing, which amounts to about 0.003 in. One point of exit is provided for the oil in the bearing, and this is directly at the center. Further, the oil is introduced where the pressure is the least. Now, with an ample supply of oil assured from a high pressure pump, there is an assurance that there will be oil in the bearing but the action of it is very strange. Let us imagine that a thin ribbon seemingly poured out from the hole in the shaft. This ribbon follows the shaft around and divides in two portions, one going toward either edge of the bearing. The ribbon advances just as a screw advances, in fact this oil film is simply a spiralled or pencilled ribbon that threads its way very gradually, revolving with the shaft but at not quite the same speed. Something like five or six revolutions of this ribbon is made before the oil finally runs off the edge of the shaft.

An engine with bearings of this type must be very carefully handled as regards oil in the crankcase. If, because of neglect, the oil has been allowed to run down, or if the engine is operated without oil for even two or three minutes' time, the bearings are very apt to be seriously injured. Experiment has proved that with an engine of this type, operation without oil will cause the bearings to pound themselves to pieces in just a few moments' time, which illustrates the cushioning effect of the oil film.

Repair on these engines, as far as the bearings is concerned, should not worry any one. Providing that lubrication has been properly attended to, there should be very little wear. But if for any reason lubrication has been neglected, the problem of taking up the bearings is a none-existent factor, for the bearings are not taken up with this type of construction. Whole new bearings are fitted and these are supplied by the manufacturer, already to drop into the bearing positions. With the accurate manufacturing limits that are necessary with this type of construction there is no need for the mechanic to do any machining or lapping when fitting these bearings. A new bearing is simply fitted in and bolted down.

Shaw a Newcomer in Motordom

Is An Assembled Car of Quality Units—Uses Four-Cylinder Duesenberg Racing-Type Engine



The Shaw body design is distinctive, having a straight-line hood and cowl effect with individual fenders

THE Shaw manufactured by the Walden W. Shaw Livery Co., Chicago, and illustrated in the show issue of *MOTOR AGE* is a newcomer in the automotive field, an assembled four-cylinder car of quality embodying many striking features in which cost has been a much subdued element. The car sells for \$5000 f.o.b. Chicago and it is estimated that 1000 cars will be built the first year.

The Shaw body is of distinctive design, having a straight-line hood and cowl effect with individual fenders, small steps taking the place of running boards and is fitted to a 136 in. wheel-base chassis. There are two windshields, one for the front and one for the tonneau, with glass wings as a part of each.

The engine is a race-type Duesenberg, 4¼ by 6 in. bore and stroke, with horizontal valves easily accessible by removing a plate. This engine was described recently in *MOTOR AGE*. The lubrication is force feed from a positive gear-driven pump with separate leads to the main and camshaft bearings. The cooling system is a positive gear-driven water pump circulating the water

and is equipped with a Sylphon thermostat, which is attached to the radiator at the inlet and outlet water pipes and automatically opens instantaneously with the warming up of the water, eliminating the use of a radiator shutter. The gasoline system comprises a 25-gallon tank with five gallons always in reserve; a gasoline gage on dash, and a Stromberg carbureter.

The electrical starting and lighting system is latest type Westinghouse with starting motor attached to the flywheel through Bendix drive. A novel feature is the location of two extra lamps underneath the hood and an oil gage light which permits an easy reading of the oil gage at all times. The ignition is Bosch waterproof high-tension system.

The car is equipped with disteel wheels with demountable rims, two extra wheels being furnished with the car.

Specifications of the Shaw

Engine: Rochester-Duesenberg, four-cylinder racing type, 4¼ by 6 in. bore and stroke.

Camshaft: Silent chain driven with patented eccentric for adjustment of chain.

Lubricating System: Force feed from positive gear-driven pump.

Gasoline System: Vacuum, 25-gallon capacity. Gasoline gage on dash.

Carbureter: Stromberg. Special design for Rochester-Duesenberg engine.

Transmission: Brown-Lipe, four speeds forward, one reverse. (Direct on third and over stepped on fourth on roadster and four-passenger models, direct on fourth speed on seven-passenger.)

Clutch: Brown-Lipe multiple-disk dry plate Raybestos lined. (Engine, transmission and clutch in one unit.)

Steering Gear: Split nut and gear, semi-reversible, easily adjustable.

Electrical Starting and Lighting: Westinghouse latest improved. Starting-motor attached to flywheel through Bendix drive.

Cooling System: Centrifugal water pump. Capacity 6½ gal. with thermostatic control attached to radiator.

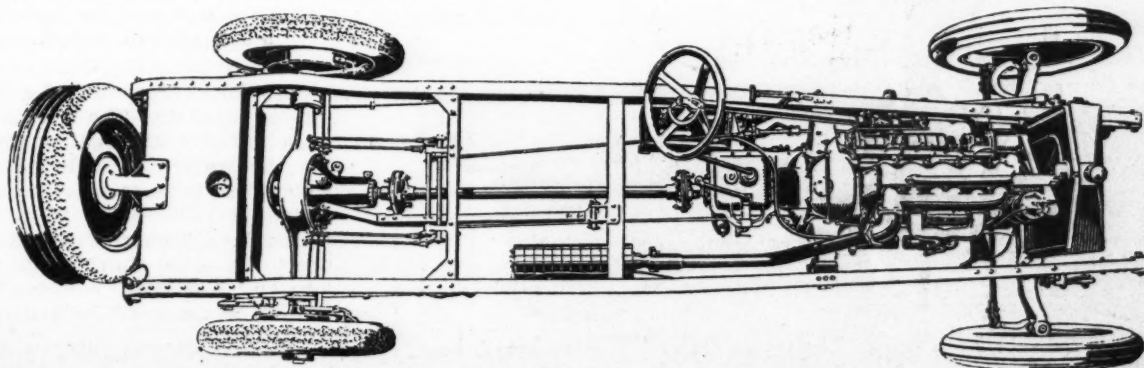
Ignition: Latest type Z R 4 Bosch, high-tension, waterproof.

Wheels and Rims: Disteel wheels, demountable rims. Two extra disk wheels each car.

Tires: Firestone cord, 32 in. by 4½ in. on roadster and four-passenger, 33 in. by 5 in. on seven-passenger touring car.

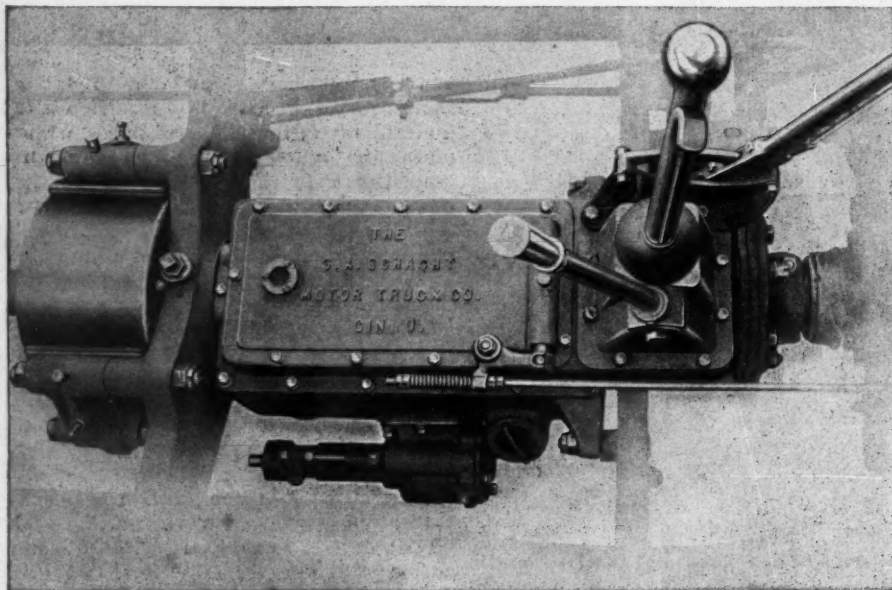
Equipment: One-man top; windshields provided with plate glass deflectors, especially designed for the Shaw car; spotlight, trouble-light, cigar-lighter, Hartford shock absorbers front and rear, gear-driven tire pump, Sparton motor-driven electric horn, 90-mile Warner speedometer, Motometer, electric inspection lamp, ammeter and gasoline meter on dash. Trunk and two suit-cases included with roadster and four-passenger models. Running board or individual steps optional.

Bodies: Two four and seven-passenger models.



Airplane view of Shaw chassis. Two extra disk wheels are standard equipment

New Schacht Truck Has Ten-Speed Transmission



The 10-speed transmission on the new Schacht 5-ton truck has 2 gear-shift levers. This transmission was designed to eliminate rapid deterioration of the engine and parts caused by drivers returning with empty truck at high speeds and also to give a wide range of gear reduction to facilitate travel on bad roads.

Eight Speeds Forward and Two Reverse; Gear Shifting Accomplished by Two Levers

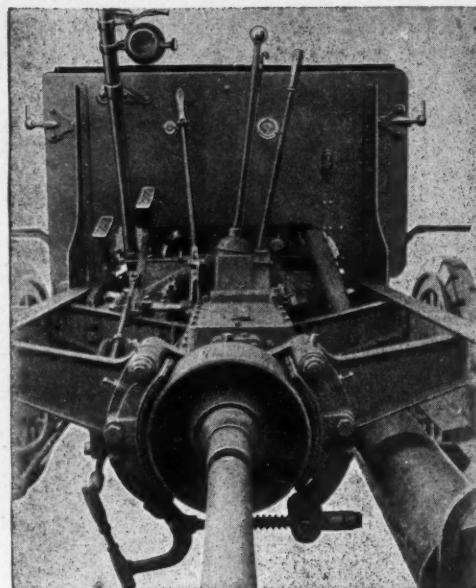
AN interesting development in truck design is incorporated in the construction of the new 5-ton Schacht truck, the development features being a ten-speed transmission. Eight speeds of the ten employed on this truck are for forward motion and two for reverse. Aside from the transmission employed on this truck there are no other features that might be called unusual and startling. The whole truck is made complete in the Schacht factory—with the exception of the carbureter, the magneto and the engine.

The chief reason for developing this transmission was to eliminate the rapid wear and deterioration on the engine and the truck parts occasioned by the tendency of the driver to operate the truck fast when returning with an

empty truck. At the same time a wide range of gear reduction is provided that enables this truck to negotiate any kind of a road where traction can be had.

With the Schacht ten-speed transmission a vehicle speed of 20 m.p.h. on high gear can be obtained with a 5-ton truck at an engine speed of 1000 r.p.m. The construction of this ten-speed transmission is practically as simple as the construction of any other transmission and compared to a regular four-speed transmission it has about the same number of parts.

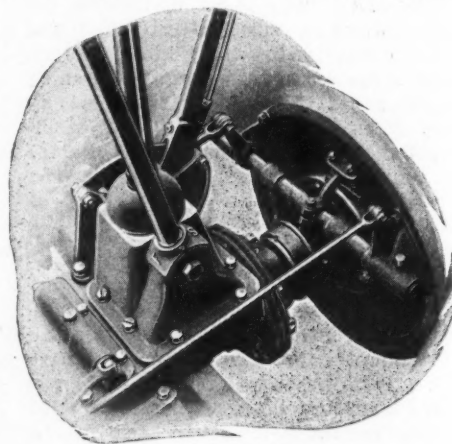
The operation is accomplished with the aid of two gear shift levers, the main gear shift lever and the auxiliary lever. The auxiliary lever has but two movements, forward and backward. The main gear shift lever controls four speeds and



The service brake is located just back of the transmission. The differential in the rear axle thus acts as an equalizer of brake action.

the reverse. The use of the auxiliary lever simply doubles the reduction of each speed making a total of eight forward speeds and two reverse speeds, supplying the power needed for every requirement and enabling the operator to select just the right speed for the occasion.

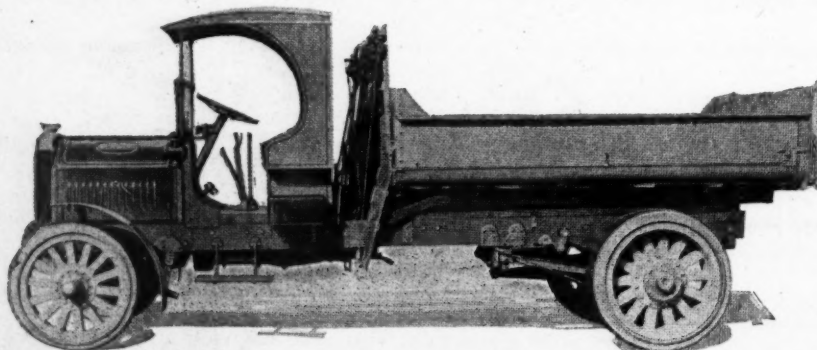
The other units of the truck are practically standard as was mentioned before. The engine has a bore of $4\frac{1}{2}$ in. and a stroke of 6 in. It is equipped with



A short auxiliary shaft connects the cone clutch and transmission with a disk joint to absorb vibration.

a Schebler carbureter and a Bosch high tension magneto. The cooling system is by a forced centrifugal pump, circulating the water through the radiator which has a removable core. A cone clutch is used which is in unit with the engine. A short auxiliary shaft connects the cone clutch with the transmission. Vibration between the transmission is absorbed by a disk joint.

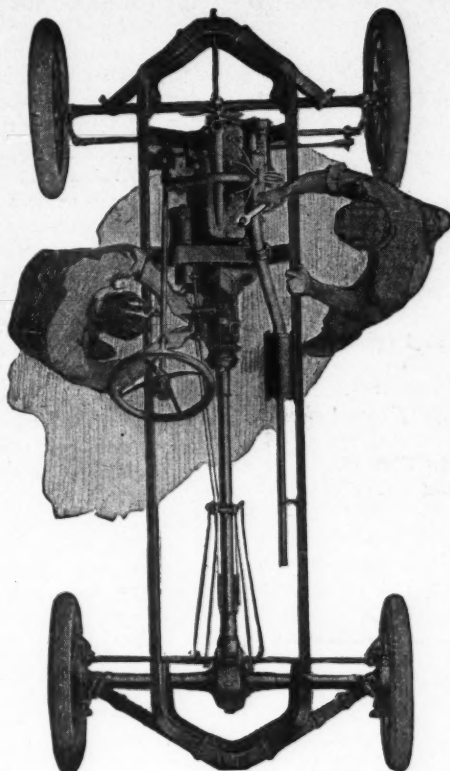
This joint does not operate at an angle but absorbs the natural vibration.



Side view of new Schacht 5-ton truck. The frame channel is extra heavy, being 8 in. deep.

SERVICING THE OVERLAND FOUR

THIS is the ninth of a series of articles dealing with the service operations on the Overland Four. The work as it stands has been prepared by the Willys-Overland Co. and the dealer will find at the head of each operation the amount of time required to do the job. The operations have been put down in a step-by-step method so that one operation is logically followed by the next. This makes it possible for the service man to have on hand all the necessary tools and equipment before beginning the job. Incidentally, the time limit set for the job affords a ready means whereby the skill of the mechanic can be judged. Other things being equal it should not take a man longer to do a certain job than herewith mentioned, as the service department of the factory has established these limits after much experimenting. Dealers who are not keeping copies of MOTOR AGE on file are suggested to do so to get the benefits of this series.



PART IX — The Engine

THESE valuable articles—Servicing the Overland Four—will run serially each week until the service operations on the entire car have been explained. This week deals with the

Engine

Next week will be a continuation of the service operations on the engine.

Keep a file of MOTOR AGE for ready reference. The flat-rate system of estimating on a job has been proved the best plan to make your service work more profitable, eliminate complaints and please your customers. The time given here for each service operation can be adapted to the flat-rate system of estimating cost of repair jobs on cars of this class.

TO REMOVE AND REPLACE CYLINDER BLOCK

Time: 20 hrs.

1. Remove hood.
2. Drain radiator.
3. Remove front splasher by removing one $\frac{1}{8}$ in. cap screw, two $\frac{3}{8}$ in. cap screws, and two $\frac{1}{4}$ in. stove bolts.
4. Disconnect battery cable at battery. Disconnect wires from lamp sockets and pull wires through shroud and radiator shell.
5. Remove radiator shell.
6. Remove $\frac{1}{8}$ in. nut from radiator stay rod and pull rod out of radiator bracket.
7. Remove $\frac{1}{8}$ in. bolts with nuts and lock washers from starting crankshaft bracket, fastened to radiator.
8. Remove two $\frac{3}{8}$ in. radiator holding down bolts with flat steel washers under head.
9. Remove one $\frac{1}{8}$ in. cap screw and lock washer from lamp stay rod and remove rod.
10. Loosen radiator hose clamps.
11. Remove radiator.
12. Remove clutch and brake pedal clamp bolts and remove clutch and brake pedal pads.
13. Unscrew accelerator button.
14. Disconnect accelerator spring.
15. Disconnect speedometer cable at speedometer head.
16. Remove floor boards.
17. Disconnect brake rod from foot brake pedal by removing cotter and clevis pins.
18. Remove clamp bolt clamping clutch pedal to clutch operating shaft, and remove clutch pedal.
19. Remove brake pedal.
20. Disconnect hand brake rod from hand brake lever, removing wing nut from rod.
21. Remove four nuts and lock washers holding gearshift box to transmission.
22. Remove gearshift box.
23. Remove drain plugs and drain transmission and engine base.
24. Remove spark control wire from distributor.
25. Remove gasoline throttle control wire from carbureter. Shut off gasoline supply at gasoline tank.
26. Remove carbureter choke wire from carbureter.
27. Remove gasoline tank to carbureter gasoline line.
28. Remove starting motor cable from starting motor.
29. Remove two clamp bolts from coupling connecting steering column to steering gear lower unit.
30. Disconnect horn wire.
31. Pull steering gear column up out of way.
32. Remove two cap screws holding muffler pipe to exhaust manifold.
33. Disconnect wires from ignition coil.
34. Loosen two clamp screws and remove ignition coil.
35. Disconnect primary ignition wire from distributor.
36. Remove nuts and lock washers from engine holding down bolts.
37. Remove engine shields.
38. Remove generator wire.
39. Put chain around engine.
40. With crane or chain falls, carefully remove engine from frame. Place engine on suitable bench or engine stand.
41. Remove cap screws holding starting motor to engine base.
42. Withdraw starting motor until hand can be inserted to reach starting motor pinion.
43. Rotate pinion until counter weight is on top.
44. Remove starting motor.
45. Remove all cap screws holding transmission assembly to engine base.
46. Remove transmission assembly.
47. Drive out taper pin and remove fan pulley.
48. Remove distributor head and wire assembly, by removing two machine screws, clipping wires to hot air stove.
49. Remove hot-air stove by removing two nuts holding hot-air box to manifold.
50. Remove carbureter by taking out two nuts.
51. Remove water inlet manifold by removing two cap screws.
52. Remove grease cup and fan stud by removing stud spring and washer, and remove fan.
53. Remove three manifold yoke nuts.
54. Remove intake and exhaust manifold.

55. Remove three cap screws holding generator to engine case.
56. Remove generator.
57. Remove wing nuts from valve covers and remove valve covers.
58. Remove wing nuts from oil sump cap.
59. Remove cap and oil strainer.
60. Remove camshaft bearing dowel screws located at side of engine base.
61. Remove oil line plugs.
62. With special socket wrench, remove cap screws holding cylinder head to engine block.
63. Remove cylinder head and gaskets.
64. Remove sixteen cap screws holding oil base to engine.
65. Remove oil base.
66. Remove cap screws from engine timing gearcase and remove gearcase cover.
67. Remove cotterpin from camshaft nut and remove camshaft nut and washer.
68. With gear puller, pull cam gear.
69. Remove cap screws holding camshaft front bearing to engine case.
70. Remove camshaft bearing, as shown in Fig. 15.
71. Remove cotterpin from crankshaft front cover cap and remove stud nuts.
72. Remove crankshaft bearing front cover cap.
73. Remove cotterpins from connecting rod bearing cap screws and disconnect one connecting rod at a time from crankshaft.

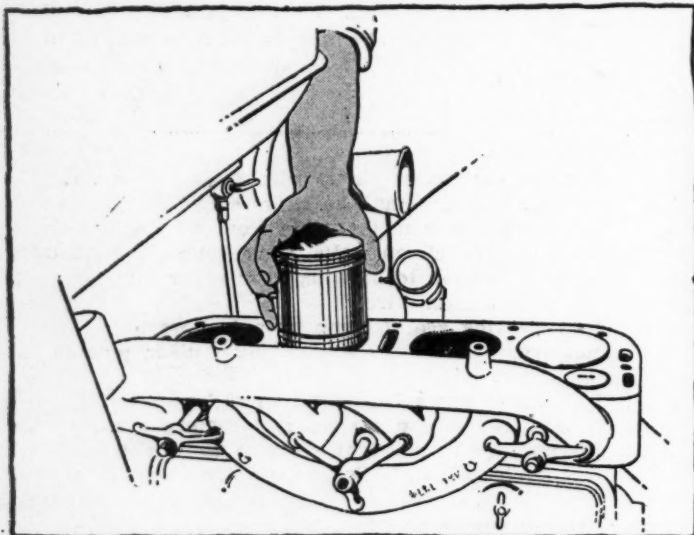


Fig. 12—Removing piston and connecting rod assembly

74. Replace bearing cap and nuts on connecting rod.
75. Pull piston and connecting rod assembly through top of cylinder block, as in Fig. 12.
76. Remove all connecting rods from crankshaft in same manner.
77. Remove cotterpins from crankshaft bearing cap stud nuts and remove stud nuts.
78. Remove bearing caps and lift out crankshaft.
79. Remove bearing shims, tying together each set of shims removed from each stud and mark with the location of bearing from which they were removed.
80. Remove bearing shells from base and caps.
81. Put on caps and stud nuts.
82. With valve-lifter, lift each valve spring and remove valve spring pin.
83. Lift out valves.
84. Remove valve springs. It may be necessary that the camshaft be turned slightly to bring pushrod to its lowest point of travel in order that springs may be easily removed.
85. Remove camshaft and pushrods.
86. Place new cylinder block on suitable engine stand.
87. With air hose, blow out any obstruction in the oil line through plug holes in engine case.

88. Clean engine case bearing receptacles and install upper crankshaft bearing shell.
89. Place two $\frac{3}{8}$ in. wooden blocks between gear shifter bearing and clutch plate. Remove cap screws holding clutch plate to flywheel and remove clutch plate.
90. Remove clutch pressure plate.
91. Drive out pressure plate dowels.
92. Remove asbestos rings and driving plate.
93. Remove cotterpins from flywheel bolt nuts.
94. Remove flywheel bolt nuts and remove flywheel bolts.
95. Remove flywheel.
96. With a light coating of Prussian Blue cover main bearing surfaces of crankshaft.
97. Set crankshaft in bearings and rock backward and forward.
98. Remove shaft and scrape lightly the blue spots from the bearings.
99. Continue this marking and scraping operation until the blue markings show a good bearing surface in the bottom and well up on the sides of the bearing.
100. With crankshaft in position, coat main bearing surfaces of crankshaft with Prussian Blue and install bearing shims and caps so that they fit snugly to the crankshaft.
101. Remove caps and scrape cap bearings, as outlined in the scraping of the upper half bearings, until a perfect bearing has been obtained in all cap bearings. If new crankshaft or new connecting rod bearings are installed, new connecting rod bearings should be fitted by marking the crankshaft bearing surfaces with a light coating of Prussian Blue. Both upper and lower connecting rod bearings should be fitted at each marking until proper bearing surface has been obtained.
102. After all bearings have been fitted, remove crankshaft and assemble flywheel with four flywheel cap screws, nuts and cotterpin.
103. See that camshaft bearing and pushrod bearing surfaces are clean.
104. Oil each pushrod with a good grade of engine oil and install in engine base.
105. Lubricate rear and center camshaft bearing surfaces on camshaft and install camshaft.
106. See that front camshaft bearing is clean and the bearing surface well oiled.
107. Install front camshaft bearing in case with two cap screws, lock washers under head.
108. Cover all crankshaft bearing surfaces with a good grade of engine oil and install crankshaft in case.
109. Put on main bearing caps.
110. Install cap stud nuts. Tighten securely and cotterpin.
111. Assemble front auxiliary cap with two nuts. Tighten securely and cotterpin.
112. See that piston assemblies are thoroughly cleaned and coat with good grade of engine oil.
113. See that cylinder walls are clean.
114. Install piston and connecting rod assembly in engine and connect to crankshaft with marks on connecting rod cap towards camshaft.
115. Tighten all connecting rod caps securely and cotterpin.
116. Grind valves.
117. After valves have been ground, remove valves from case, marking so they can be returned to seats from which they were removed, and install valve springs and spring cups.
118. Install valves.
119. With valve lifter, put in valve spring pins.
120. Turn crankshaft until No. 1 and No. 4 dead center mark is in line with center of crankshaft and No. 1 and No. 4 piston at top of travel.
121. Put key in camshaft.
122. Turn camshaft to such a position that the cam gear can be assembled on the shaft and the gear mark on cam registers with the mark on the crankshaft gear.
123. Put on cam gear, cam gear washer and nut. Tighten securely and cotterpin.

124. With No. 1 piston at top of compression stroke, adjust No. 1 push rods to .003 in. clearance between push-rod adjusting screw and valve stem.
125. Turn flywheel one-half revolution and adjust No. 2 pushrods.
126. Turn flywheel one-half revolution and adjust No. 4 pushrods.
127. Turn flywheel one-half revolution and adjust No. 3 pushrods.
128. Install valve covers.
129. Assemble intake and exhaust manifolds, making sure that gaskets are in proper position. Tighten securely with yoke and yoke stud nuts.
130. Clean surfaces of cylinder head and cylinder head gasket.
131. Cover sides of cylinder head gasket with a good coating of heavy cup grease.
132. Put on gasket and cylinder head.
133. Screw in the four center cylinder head cap screws and tighten securely.
134. Put in the remainder of cylinder head cap screws and tighten.
135. Remove spark plug from No. 1 cylinder.
136. Insert wire in spark plug hole and turn crankshaft until No. 1 piston has reached the top of its travel on compression stroke.
137. Continue cranking slowly until the top of piston is flush with cylinder block.
138. Turn generator gear until the distributor arm of the distributor is in line with No. 1 plug wire contact post in distributor head and the breaker points are just starting to break with timer in fully retarded position.
139. Assemble generator to engine case, having mark on generator gear register with mark on cam gear.
140. Put on gearcase cover with cap screws.
141. Put on carbureter with nuts and lock washers, making sure that gasket between carbureter and manifold is in perfect condition.
142. Assemble hot-air stove to carbureter and exhaust manifold with two nuts.
143. Clip spark plug to hot-air stove with two machine screws.
144. Put on oil base with sixteen $\frac{1}{8}$ -in. cap screws.
145. Assemble first asbestos ring in flywheel.
146. Assemble clutch driving plate.
147. Put in second asbestos ring.
148. Drive in pressure plate dowels.
149. Install pressure plate.
150. Install clutch plate assembly so that all holes in clutch plate line up with holes in flywheel.
151. Put in cap screw and tighten securely.
152. Remove blocks between clutch plate and clutch bearing.
153. Assemble transmission to engine.
154. Put key in clutch shaft.
155. Put on clutch pedal.
156. Hook clutch fork over clutch thrust bearing and push forward on clutch pedal drawing transmission in place. Fasten to engine case with cap screws.
157. Screw out starting motor pinion with weight at top and install starting motor. Fasten with three cap screws.
158. Remove clutch pedal and clutch operating shaft key.
159. With engine sling, chain falls or crane, place engine in frame,—one man at rear of engine to steer torsion tube into universal joint housing. It may be necessary to pry engine into position by using a piece of scantling or long board against front end of engine case and front axle.
160. Line up engine in engine frame hangers with short pinch-bar.
161. Insert right front holding-bolt.
162. Insert right rear engine holding-down bolt. It may be necessary to use jack between frame sill and universal joint housing in order to insert right rear engine holding-down bolt.
163. Insert left rear engine holding-down bolt.
164. Insert left front engine holding-down bolt.

165. Two men put on side and front engine shields, engine holding-down bolts, lock washers and nuts. Fasten securely.
166. Place transmission sliding gears in neutral.
167. Place gearshift lever in neutral.
168. Put on gearshift housing assembly.
169. Put on four lock washers on gearshift housing studs.
170. Put on stud nuts and tighten.
171. Slip on brake pedal over clutch fork shaft.
172. Connect brake rod to brake pedal with clevis pin and cotter.
173. Put Woodruff key in clutch fork shaft.
174. Assemble clutch pedal on shaft and clamp securely with clamp bolt and nut.
175. Connect carbureter choke wire to carbureter.
176. Connect throttle control wire to carbureter.
177. Connect starting motor wire.
178. Put on gasoline tank to carbureter gasoline line.
179. Connect muffler tube to exhaust manifold with two cap screws, lock washers and nuts. Care must be taken to see that gasket is between exhaust manifold and muffler tube flanges.
180. Put on and clamp ignition coil in place.
181. Connect ignition wires to coil.
182. Connect primary ignition wire to distributor.
183. Connect spark control wire to distributor.
184. Put on fan belt.

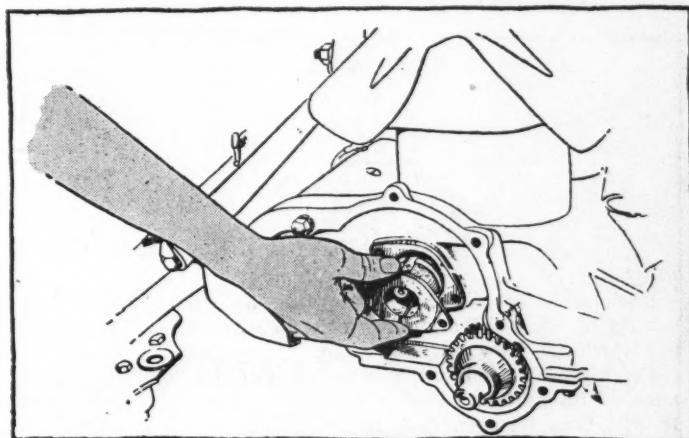


Fig. 15—Taking out front cam bearing

185. Put on radiator, lock washers and nuts, and tighten securely.
186. Assemble radiator hose and clamp tightly.
187. Put on starting crankshaft and bracket assembly. Bolt to radiator with two $\frac{1}{8}$ -in. bolts, lock washers and nuts.
188. String front lamp wires through holes in fan shroud on radiator.
189. Put on radiator shell, lacing headlight wire through hole in radiator shell.
190. Slip front splashers under radiator shell and line up holes on shell and splashers. Fasten assembly to frame with one $\frac{1}{8}$ -in. cap screw, two $\frac{3}{8}$ -in. cap screws and two $\frac{1}{4}$ -in. stove bolts and nuts, using flat washers under cap screw heads.
191. Put on front lamp stay-bar.
192. Connect front lamp wire to lamp sockets, and connect battery cable to battery.
193. Put on radiator stay-rod.
194. Fill radiator with water.
195. Put one and one-half gallons oil in engine base, through engine breather tube.
196. Connect speedometer cable.
197. Put in floor boards.
198. Put on pedal pads.
199. Connect accelerator spring.
200. Screw on accelerator button.
201. Tune up engine.
202. Put on hood.

Standard Mechanical Operations in Tractor Service

by John Charles Thorpe, M.E.
and Gustav Howard Radebaugh

EDITOR'S NOTE: The two pages herewith are the eleventh of a series covering the service operations on tractors, although the same can be applied quite generally to passenger car and truck engines. In last week's issue of *MOTOR AGE* we told how to correct a damaged needle valve or seat. This installment deals with the troubles caused by incorrect float level and how to obtain the correct adjustments. It is often the case that the more simple a trouble may be the more difficult it is to locate. It is with this in view that we present this series which deals with the everyday problems that may confront the tractor owner and tell here how to locate and remedy these troubles.

PART XI

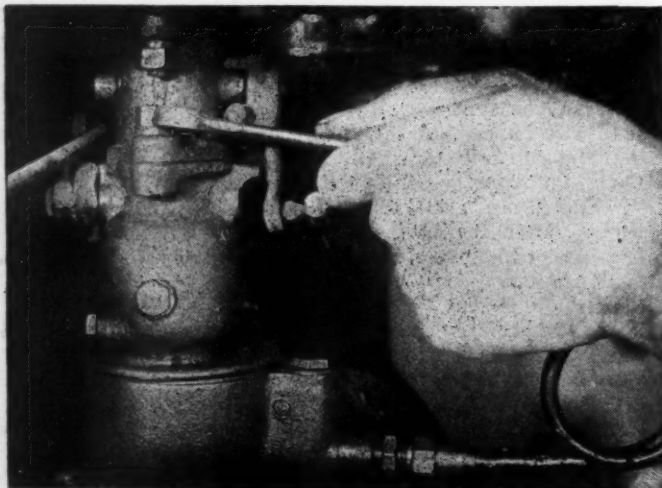
Carbureter Troubles—Adjusting Float Level

Carbureter Troubles. Float level. The general constructive details of the float and float chamber are shown clearly in the sectional view on next page.

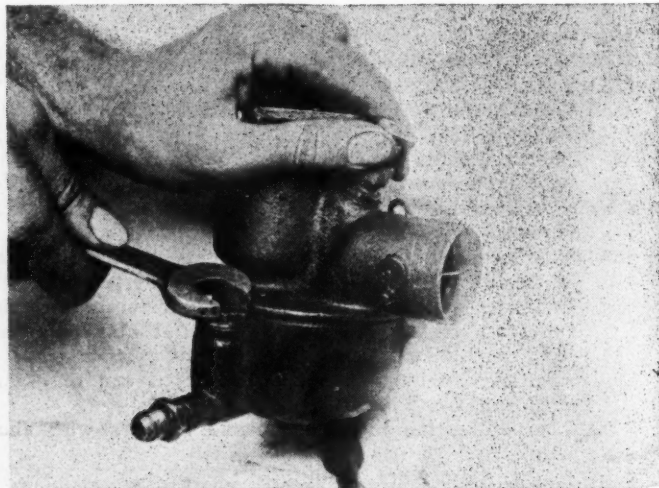
From the discussion of the function of the float the importance of its part in proper carburetion has been understood. It will thus be seen that if the float level is too high, too much fuel will pass through the needle valve, thus causing a sluggish action of the engine, which the ordinary operation of carbureter adjustment will not remedy. The engine will not breathe freely, thus giving the effect of being smothered.

Similarly, if the float level is too low, sufficient fuel will not pass through the needle valve to meet the demand for power, giving rise to the familiar action of "coughing" or "spitting," which in this case cannot be remedied by the ordinary operation of carbureter adjustment.

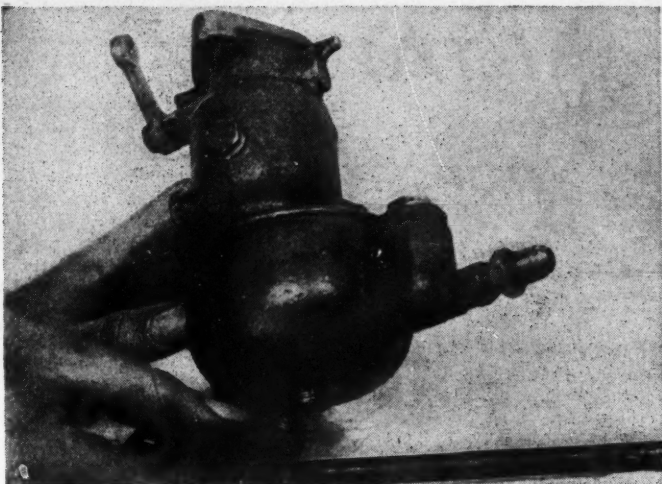
The improper level of the float may be due to improper adjustment when the carbureter was originally assembled or it may be the result of violent or unusual shocks or jarring of the machine, causing it to bind on the side of the bowl. The condition is indicated by the symptoms described.



1—Remove machine screws from flange at the top of carbureter, being careful to hold instrument firmly in order that it may not be damaged or broken by falling, or by violent contact with other parts of machine



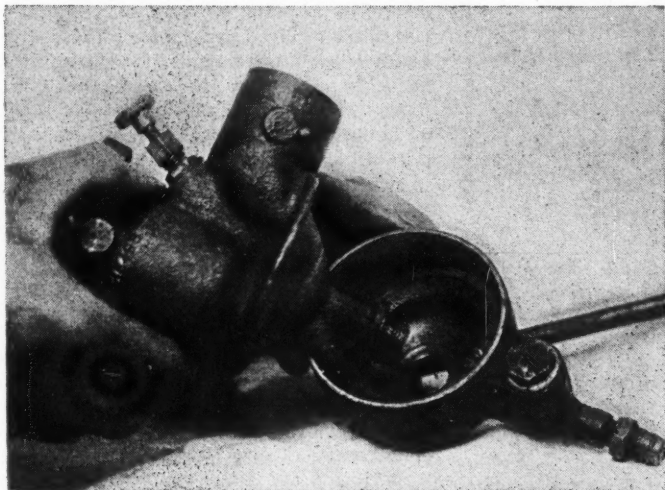
2—Remove plug from above the float valve mechanism. This not only facilitates the operation of adjusting the float level, but also permits the inspection of the float valve mechanism which will be considered in the next operation



3—Float chamber may now be easily removed from the body of the carbureter by unscrewing the large nut at the bottom of the bowl



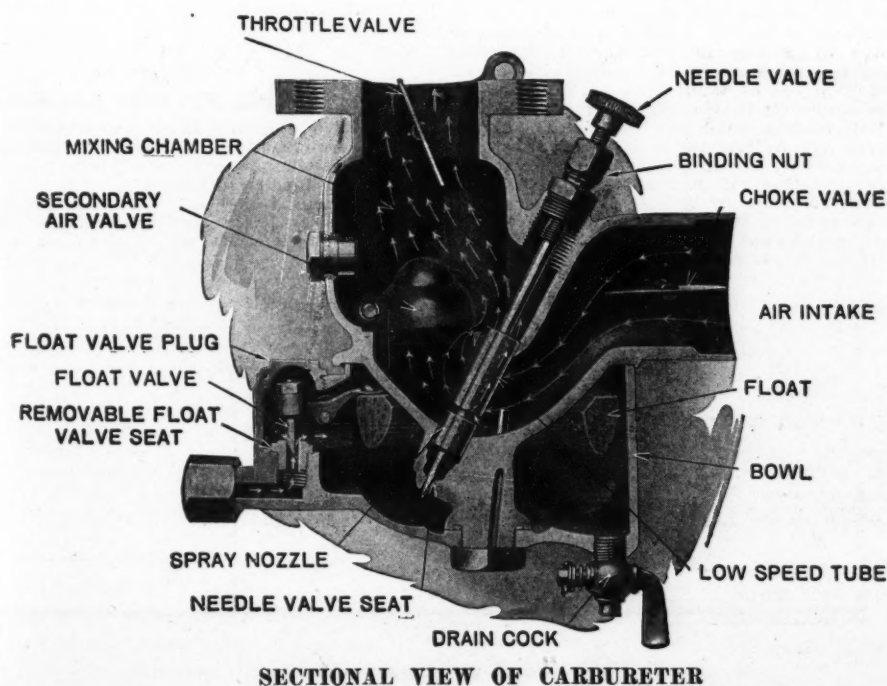
5—Raise float level by holding the float valve mechanism rigidly in place by pressure applied with screwdriver. Using a pair of pliers as shown bend the connection with the bell crank lever connecting the float with the float valve slightly upward



4—In removing the float chamber or bowl the operator should be careful not to wrench or bind the float mechanism. This view shows the bowl detached with the float in place



6—To lower the float, hold the float valve mechanism rigidly in place with the pliers. Using the screwdriver as a pry, bend the connection with the bell crank downward slightly



It must be borne in mind that a slight change in the float level will produce a marked change in the engine operation, so that the displacement of the float in procedure 5 and 6 must be carefully done.

As previously described, whether the float level is to be raised or lowered will be determined by the "symptoms" of trouble indicated by the engine performance. After the adjustments are made, the carburetor must be assembled, fuel connections made, and the usual course of adjustment pursued. The operation must be repeated until the performance of the engine indicates no fault in the float level.

Next week's installment of this interesting and educational series will also deal with the troubles of carburetion and how to remedy them. The carburetor being a most vital part of the automotive engine it is necessary that it function properly to secure the fullest measure of the engine power and in the most economical manner.

Garage Planning

Service Station Arrangements

No. 210

CONDUCTED BY TOM WILDER

SMALL TOWN SERVICE STATION

Will you please through your garage planning department give me your expert advice in regard to designing a garage from the information I am giving in sketches and this letter.

The enclosed sketch shows size of the building and its relation to the streets and alleys. Also a plan proposed by a contractor.

This town is small so there would be only two divisions as to departments. The repair department and the sales including the sales of cars, tires, accessories, etc. The repair shop will be equipped to take care of storage battery, starting, lighting and ignition work as well as welding and general repair so if you will give proper placing of equipment it will probably save a lot of time and expense in getting properly placed at first. At first, we will probably have four men in the repair shop but don't expect that four will be able to handle the work after getting going in full blast so it would probably be better to figure on six or seven in the shop.

As this town is only 500 population I question the advisability of having as large an office and show room as indicated in my sketch. The only time we would have much use for it would be in the winter when the roads are closed up to automobiles, that is outside of the accessory line for the summer season. The stock of accessories including a \$4,000 stock of tires would amount to about \$6,000.

The building is to be of hollow tile construction with a cement floor and we propose to have it heated with pipeless hot air furnaces. Would like to have you suggest the proper placing of furnaces for the heating of the building so the main storage part would not allow cars to freeze in cold weather and keep the shop and office warm too. We figured on two furnaces.

For storage we figured on live storage for 25 to 30 cars but winter when the place will be packed 40 to 45.

Hoping that I have covered the necessary information required and thanking you for this service I am, R. H. Prom, Milton, N. D.

Your show room is not large enough to show any cars though you might cut it down slightly if you only want to show accessories and tires. However, it would be doubtful economy to make your store so cramped that three or four persons would crowd it for the sake of gaining space for storage of one car.

The placing of these furnaces is not so important so long as they are fairly centrally located in the area to be heated. It would not give results to place a furnace in one corner and expect to heat the opposite side. The locations you have shown should work out pretty well. Perhaps you could arrange to have registers on two sides of the walls separating shop from garage, and office from garage with a sliding or butterfly damper that would divide the flow of air and regulate it. Once set to give

MOTOR AGE is receiving many inquiries for garage plans which do not give sufficient information to permit an intelligent reply. There are certain things which should be known to lay out the proper plan for a garage, and inquiries are urged in asking for such plans to be used to include the following information:

Rough pencil sketch showing size and shape of plot and its relation to streets and alleys.

What departments are to be operated and how large it is expected they will be.

Number of cars on the sales floor.

Number of cars it is expected to garage.

Number of men employed in repair shop.

And how much of an accessory department is anticipated.

the right division these dampers would need no further adjustment unless in the case of high wind.

No. 211

COMPANY GARAGE AND SERVICE STATION

Please suggest one or two plans for a one story concrete garage to be used only for the storing and repairing of about 30 various sizes of trucks and passenger cars of a big manufacturing company plant located one mile outside city limits on 30 acres of land with various factory buildings on it, we wish to have a repair shop with a good set of tools and overhead track or crane, a wash rack in one corner, small office for superintendent, gasoline pump, for men also a lunch room for drivers and stock room.

In addition there are about 20 cars of the employees, which are being stored during working hours only, give your

opinion as to having separate stalls in back of main garage for same as the stalls would have to be heated and prevent things from being stolen. Please also give your opinion in regard to fire sprinkling system, skylights, pits in repair shop or anything you may deem practical. Thanking you very much.—Otto Hahn, Milwaukee, Wis..

You have given no dimensions in your layout so we judge you are not hampered by limitations of this sort.

We do not favor the separate stall scheme. The stalls must be much larger than the space ordinarily taken by a car and aside from the heating the cost would be much greater. Thefts which occur in a place of this sort must be committed by the men themselves against each other and it ought not to be a hard matter to catch the guilty ones. Another reason would be economy or double use of space; if these cars are only in during working hours they are in while the company trucks and cars are out.

We have no figures on the value of sprinkler systems and while we think they would be more generally used if of decided value, there is undoubtedly an advantage in them. The weak point in sprinklers is that water is of little value in checking fires of burning oil and gasoline. A liberal supply of chemical extinguishers is much more effective in an emergency.

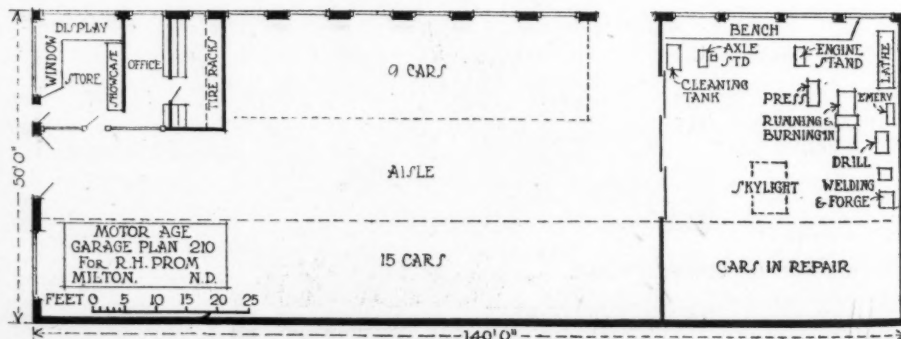
Skylights are a necessity in a building of this sort. Pits are of value if used but we have seen many of them boarded over to make the floor space available for other things and men lying under the cars to work rather than remove these pit covers.

No. 212

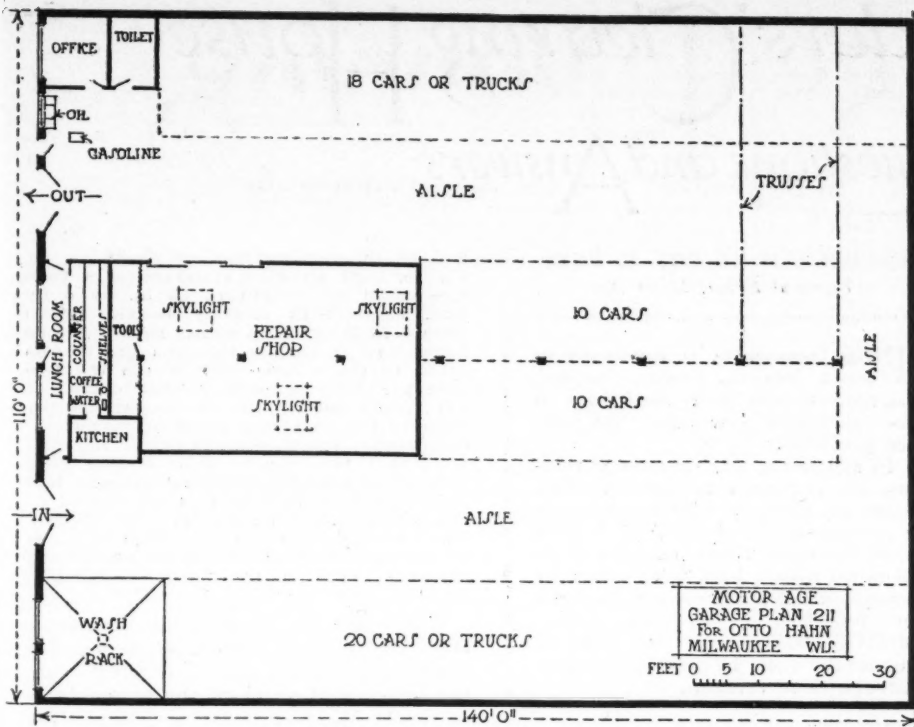
FORD SERVICE STATION ENLARGED

We are contemplating an addition to our present building and are writing you for suggestions as to the plans for our proposed larger quarters.

We have the Ford car and Fordson tractor agencies, and of course handle the various implements which are sold with the tractor.



No. 210—Small town service station



No. 211—Company garage and service station

We enclose herewith a rough sketch showing our present building, which also shows a plan which we have in mind for the new addition. The idea which we carried out in the enclosed sketch is to enlarge our shop to about 75 ft. and arrange our stockroom so that it will be more accessible to the shop.

We propose to move our offices, and parts and accessory stock to the new addition and use the space now used as a parts and accessory department as well as display room, as strictly a showroom. Our present storage space, we propose to use as a storage room for new cars, tractors and implements.

We do not do any battery work, neither do we maintain a tire repair shop, our efforts being confined to the sale of Ford

cars, Ford trucks, Fordson tractors and allied implements; and giving service on Ford cars and Fordson tractors.

Our parts and accessory department must be amply large to take care of a \$15,000 to \$20,000 stock of Ford parts, and an \$8,000 to \$10,000 stock of tires, tubes and accessories.

We believe the enclosed sketch will give you a very good idea of what we have in mind, and we shall be very pleased to receive any suggestions you may have to offer, as we feel your knowledge of up-to-date plans for sales and service stations will be of great benefit to us in deciding on a plan which will best take care of our requirements.

Thanking you for your trouble in this matter, and assuring you it will be great-

ly appreciated, we are, Gunsolly Motor Co., Emporia, Kas.

You will notice that we have stuck very closely to your layout as you have about the right idea. It would be well to take down the old wall dividing the showroom in order to get the benefit of the impression the large room will have on customers. It would also be well to remove the wall in the shop for convenience, a post will probably be needed in both cases.

We will not make any shop layout not knowing what you have at present and believing that you are well able to handle that yourselves.

Made Good by Being on the Job

(Concluded from page 13)

ings with a degree of sympathy has built up one of the strongest labor organizations enjoyed by any St. Louis garage and agency. All employees are afforded extensive lockers, wash-rooms, and shower baths. They are annually given substantial bonus for their individual merit and are thus molded into one constructive force.

The Riefling concern handles one of the largest stock of accessories and parts in the entire city. Having such quantity and vastly different parts always on hand enables prompt attention to the consumer and prevents irritation and impatience resultant upon delay.

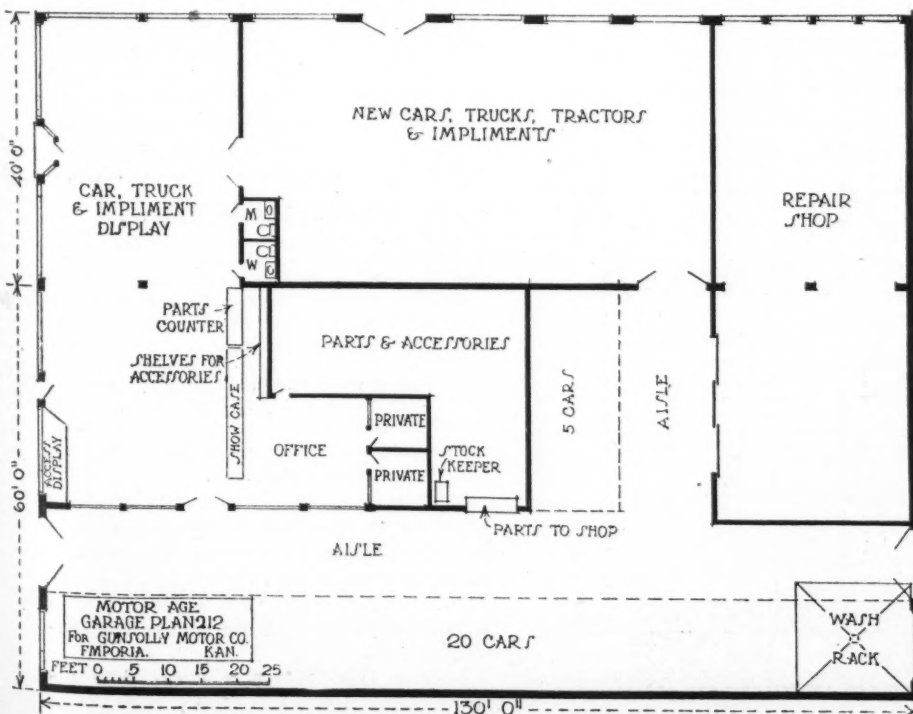
"We have studied the trade for the three years we have been in business," asserted Mr. Riefling, "and find that we are approximately 99 per cent efficient in handling new or damaged cars on our premises. Our service is our best advertising asset, although we do extensive advertising by billboard and direct mailing.

"Three years ago we started with almost nothing and today we have a \$50,000 plant besides its furnishings and machinery. We lay all our success to the aforementioned seven reasons and to no other factor. I believe many other garage and agency men can profit by specializing in one car as we, Ford agents, are required to do. It means greater efficiency and that leads to material successes."

The plant covers an area of 12,128 sq. ft. and requires the services of 42 employees.

PICKING POSIES A PUNK PASTIME

Cincinnati, O., April 10—The Cincinnati Automobile Club is co-operating with the Garden Club of Cincinnati in a campaign against automobilists plucking flowers from the roadside where they have been planted by the Garden Club members. License numbers of the machines whose drivers are observed to be engaged in this practice are reported to the Automobile Club, which writes the owners asking them to cease the practice. Failure to heed the warnings will result in publication of names of wilful offenders in Honk-Honk, the official magazine of the Automobile Club.



No. 212—Ford service station enlarged

The Readers' Clearing House

Questions and Answers

HANDLING PRESENT-DAY FUEL

Q—Instruct how to take up end play in a Continental 7-N engine installed in a 1917 Westcott car.

2—Has the gasoline deteriorated sufficiently since the Rayfield Model M of that year was designed to justify buying a more recent carburetor for that car?—Robert E. Gardner, Ensley, Ala.

1—The only way the end play can be taken up is by refitting a new set of main bearings.

2—Probably the most important topic under discussion in the automotive engineering field to-day is the fuel question. Extremely high prices of gasoline and oil have been predicted, based on figures which show that there is a greater increase in demand for fuel than there is in its production. The only way to maintain a point of stability of fuel supply is to make use of some of the heavier fractions of the petroleum products which are now considered unfit for automotive use, or possibly by an extension of various cracking processes.

The curves shown in Fig. 1 represent facts in regard to the character of the fuel marketed in the past few years and are of three characteristics which are of special interest. You will notice that the gravity, Baume, readings are coming down slowly, but the initial boiling point has not changed very much. This means that there will not be much trouble in starting engines in cold weather, but since only the lighter constituents of the fuel volatilize and as the percentage of lighter constituents is going down, it is necessary to get a larger amount of gasoline into the cylinders to have enough of the lighter constituents to start combustion. The driver is interested in carburetion first because of spark-plug fouling. It has been found by repeated experiments that carbon deposit and fouling plugs is not caused by over-oiling in most cases, but by the presence of wet fuel on the plug. This, of course, shows that as nearly dry a mixture as possible is very desirous.

The second question of importance to the driver is engine performance during cold weather. Many schemes have been tried, such as thermostats, hot-spots and heated air intakes, all of which helped the situation some, but the engineer must continue to improve the carburetor in order to stay abreast of the times. The third thing of importance to the car owner is the contamination of the lubricating oil by fuel which passes the pistons. The average driver will not take the trouble of draining off the oil at comparatively short intervals in winter and as a consequence the lubricating system soon becomes filled with a mixture of fuel and oil of little or no lubricating value.

There is no question but what great

CONDUCTED BY ROY E. BERG

Technical Editor, Motor Age

THIS Department is conducted to assist Dealers, Service Stations, Garagemen and their Mechanics in the solution of their repair and service problems.

In addressing this department readers are requested to give the firm name and address. Also state whether a permanent file of MOTOR AGE is kept, for many times inquiries of an identical nature have been asked by some one else and these are answered by reference to previous issues. MOTOR AGE reserves the right to answer the query by personal letter or through these columns.

MISCELLANEOUS

strides have been made in carburetor design since 1917, and with the aid of this little article you can readily see that there must be carburetors and devices on the market now that will improve your carburetion.

THE USE OF OVERSIZED TIRES

Q—It is well known that the use of tires a size larger than the standard equipment of the average car, when properly inflated, decreases the tire cost per mile, increases the ease of riding and saves by better cushioning particularly the unsprung parts of an automobile. With

a 3700 lb. car equipped with 32 in. by 4½ in. cord tires as standard, if a cord tire could be bought of 33 in. by 6 in. size, made with slightly heavier walls than a 33 in. by 5 in. and if rims could be bought to fit such a tire and the wheels fitted to those rims—(a) Would the tire cost per mile show a further decrease? (b) Would not the life of the car and especially the unsprung parts be materially increased? (c) Would the power required to propel the car be merely nominally greater on smooth roads and actually less on rougher roads (the vertical motion of the axles being lessened)? (d) Would there be any injury to the wheel bearings or steering mechanism by reason of the greatest weight of the tires?—C. William Hansen, New York.

It can not but be admitted that oversized tires do add materially to the riding comfort of the car. The effect upon the component parts of the assembly is to reduce their vibrating and lessen the jar when surmounting the undulations of the road. But whether the wheels should be equipped with tires greatly over the standard size we can not say. There will be a certain limit, beyond which one can not go, when applying tires of greater than the recommended size. Tires of large section cost a good deal more than just a proportionate increase compared to tire size. The effect of accelerating such an equipped wheel would not add very much to the load. The riding comfort of the car would be increased, and the wearing qualities of the axles and wheel bearings would be enhanced. There would be no injury done the wheel bearings, but there might be some slight conflict as regards the steering gear. The caster action which is the combination of the toe-in with the camber is designed to accommodate one size of tire. The next tire in over-size, it has been found, does not interfere with this caster action, but if carried too far, a point would be reached where this would interfere.

RACING RECORDS

Q—What is best speed attainable with the Hudson, Stutz, Studebaker Big Six, and Mercer stock car models?

2—Who holds the world's record for 1 mi., 500 mi., and with what cars?

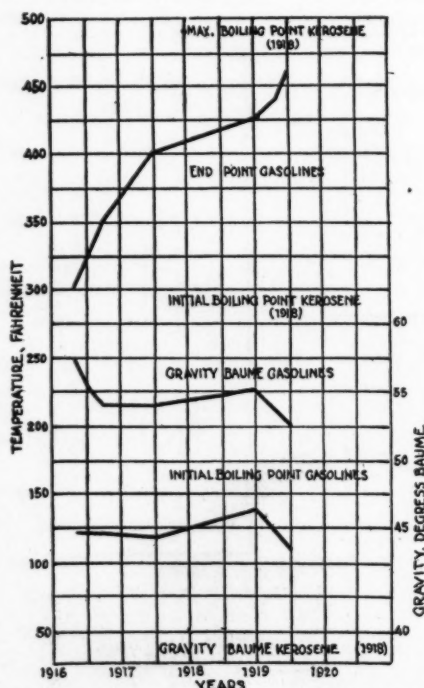
3—Which type of engine is used most in racing cars, the 4, 6, 8 or 12-cylinder?

4—Has a world's record ever been made in a 4-cylinder racer?—George T. Flott, Emporia, Kan.

1—The speed of the cars are about 70, 80, 60 and 80, respectively.

2—Ralph DePalma and his Packard hold the 1 mile record. This was made at Daytona Beach, Florida. The world's record for 500 miles in a competitive race is 97.58 m.p.h. which was made by Dario Resta in a Peugeot at the Chicago speedway in 1915.

3—The type varies a great deal although the 4-cylinder cars have been most popular in the past.



VARIAIONS IN GASOLINE FROM 1916 TO 1919 INCLUSIVE. BASED ON DATA OBTAINED FROM GASOLINE PURCHASED IN CARLOADS

Fig. 1

4—A world's record was made by Arthur Duray in a 4-cylinder 300 h.p. Fiat.

ROAMER SPEED

Q—What is the maximum speed obtainable with the 1920 Continental equipped Roamer model 6-54? At what engine speed is it reached?

2—What is the maximum speed obtainable with the 1920 Duesenberg equipped Roamer? At what engine speed is it reached?

3—Give gear ratios of all speeds of the Roamer car.—Y. F. Lee, Boston, Mass.

1—The speed of this car is about 60 to 65 m.p.h. at a maximum and is obtained at an engine speed of about 2100 r.p.m.

2—Seventy-five to 80 m.p.h. at 2600 r.p.m.

3—This information is unavailable.

MAKING COLD CHISEL

Q—Explain method of tempering chisel for cutting shafting, cast iron, etc.—L. J. Hurlbutt, Rhinelander, Wis.

Steel that is generally used in making chisels for cutting cast iron and steel is what is known as Bessemer steel, and is just a common type of carbon steel. When making a cold chisel the first thing is proper forging. The steel should be heated up slowly and an attempt should be made to keep the heating as uniform as possible. When it reaches a bright yellow heat it can be removed from the forge and worked to shape on the anvil. Work your steel while it is hot and do not attempt to wait until it is cooled down and then try to force it into shape with a hammer. Great precaution must be taken not to force the heating of the steel as it is very apt to burn the steel before you can remove it from the forge and work it. After it has been shaped, the next thing to do is to harden it. The process is to make it a good deal harder than is necessary and then cut it by slowly heating and gradually softening it until it is just right for the work. Heat the steel to a bright cherry red bringing it up gradually, harden it by dipping it into water at about 60 deg. Fahr. remembering to dip it by holding in a vertical position so that the hardening will be uniform. The next step is tempering. Tempering steel is the act of giving it, after it has been shaped, the hardness necessary for the work it has to do. A piece of steel properly tempered should always be finer in grain than the bar from which it is made. If it is necessary in order to make the piece as hard as is required, to heat it so hot that after being hardened the grain will be as coarse or coarser than the grain in original bar, then the steel itself is too low carbon. The process of obtaining the required hardness or temper of steel is to supply heat and watch what is known as drawing and is the running of the colors. When heat is supplied as shown in Fig. 2, the first color that will appear is a very dark straw color. It is to be remembered that in order to see these colors very plainly it will be necessary to clean the tool to be tempered with a little emery stone or emery paper. This dark straw color will run down toward the tip of the tool and will be followed by a light straw color, then a dark purple, a light

To assist readers in obtaining as a unit all information on a certain subject, MOTOR AGE segregates inquiries in this department into divisions of allied nature. Questions pertaining to engines are answered under that head and so on.

Miscellaneous

Robert E. Gardner.....Ensley, Ala.
C. William Hansen.....New York
George T. Flott.....Emporia, Kans.
Y. F. Lee.....Boston, Mass.
L. J. Hurlbutt.....Rhinelander, Wis.
H. Gransbury.....Driftwood, Okla.
B. R. Costin.....Little Rock, Ark.
A. Reader.....Minneapolis, Minn.
E. A. Fisher.....Lima, Ohio
Morice Krikeeng.....
J. G. Gilchrist.....Hot Springs, S. D.
B. A. Liehr.....Versailles, Ill.
J. B. Jones, Gordonville Garage
.....Gordonville, Tex.
Joseph Ruzicka.....Chicago
H. Dunlop, Keane's Garage
.....Steuenville, Ohio

Axles and Gears

Harry T. Baxter.....Nauvoo, Ill.
J. R. Refaum.....Buffalo, N. D.
Carl F. Mix.....Clear Lake, Minn.

Engines

J. R. Refaum.....Buffalo, N. D.
H. S. Brown.....Newark, N. J.
Clifton B. Norris.....Willow Shade, Ky.
Reid Hanselab, Dennis Kent &
Horn.....Duluth, Minn.
E. J. Oliver.....Chicago
L. V. Willard, Ponca City Machine
Shop.....Ponca City, Okla.
W. B. Balmer.....Industry, Ill.
R. F. Dickson.....Kansas City, Mo.
R. B. Biggs, River Road Garage
.....Tiffin, Iowa
Russell J. Walters.....Quincy, Ill.

Rebuilding

A. R. Cooper.....Seattle, Wash.
K. S. Douglass.....Ripon, Calif.
Edward B. Allen.....Mansville, Ill.
J. Wylie Candle.....Ellsworth, Ia.

The Electric System

E. G. Hagen.....Kimberly, Idaho
N. J. Martin.....Rushford, Minn.
C. H. Gardner.....Oakland, Calif.
B. C. Laub, City Garage
.....Maskell, Neb.
Raymond F. Mauzert.....
.....Gloucester City, N. J.
W. H. Ahrens, King Highway
.....New Rochelle, N. Y.

purple, a bright blue, a bluish gray and then the normal color of the steel. A cold chisel to be used for steel is always tempered to a light purple which is about

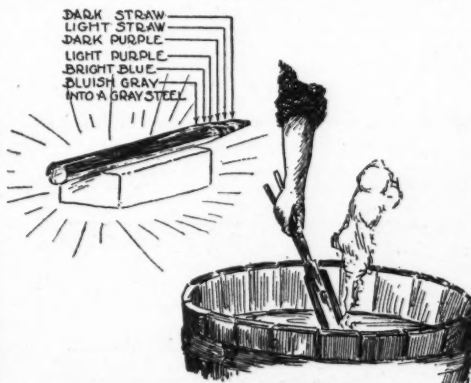


Fig. 2—Method of tempering a cold chisel and drawing the temper, showing the various colors that will be obtained

530 deg. Fahr. and cold chisels used for cast iron a dark purple or about 550 deg. Fahr. When colors begin to run they travel very fast and it will be necessary to have a bucket of water very close at hand so that the tool may be cooled quickly in order to retain the desired temper.

FORD COMPANY

Q—It is rumored that Henry Ford and Son are going to bring out a new car which will be entirely different from the old Ford models; is this true, and if so, have they sold the Detroit factory, and where is the new factory to be located?—H. Gransbury, Driftwood, Okla.

This is merely a rumor and so far as we know there will be no immediate change in the Ford organization. Ford stock is all in the hands of Henry Ford & Son with the exception of about 14 per cent.

SPEEDOMETER REGISTERING

Q—Have a 30 by 3½-in. tire on the front wheel of a Ford to which a speedometer for a 30 by 3-in. tire is attached. What difference will these two casings show in traveling 27 miles?—B. R. Costin, Little Rock, Ark.

There will be no difference in the travel in these two cases because an increase in the width of the tire has nothing to do with the distance that the wheel will move in one revolution.

OAKLAND DRIVE CHAIN ADJUSTMENT

Q—How much play or slack can be allowed in the timing chains on a Big Six Oakland car model 6-60, and can same be taken up and made tight?

2—Is there any danger of too high compression and what are the results?

3—What size pinion and sprocket is needed on the speedometer when using 35x5 cord tires?

4—When brakes are used, the car slows down but takes a long time before motion of wheels ceases entirely. The brake doesn't seem to be properly adjusted. Explain how to adjust the foot and emergency brakes.

5—What is the speed of the Big Six Oakland car, model 6-60?—A Reader, Minneapolis, Minn.

1—A slightly noticeable play in the drive chain is all that should be allowed to exist in order to obtain quiet operation. By grasping the chain itself between the gears and moving it up and down a movement of about ¼ in. gives this quiet operation. The eccentric idler gear can be turned on its axis, which will take up the slack in the belt.

2—Compression is a factor that is not controlled by the driver. It is a set condition that the designer estimates when laying the engine out. The only danger that is apt to result from too high compression on your car, which would be caused by a mistake of the designer, would be that your engine develops more power than you are taxed for. An engine is apt to produce a dull pounding thud when operated on low grade fuel with high compression.

3—With a Stewart speedometer a 70-tooth wheel sprocket will be necessary, together with the standard fibre swivel head gear.

4—Unless the brake lining has been renewed since the car was purchased

it is probable that it needs new brake lining at this time. You will find an adjustment nut on the brake drum where the brake rod is secured to the lever on the axle housing. By turning this up more effective use of the brakes can be made. It may be necessary to remove the clevis pin from the brake rod and turn the clevis down about three or four turns and then insert the pin. This will shorten the brake rod and allow the brake to take hold at an earlier period in the stroke of the pedal.

5—At an engine speed of 2000 r.p.m. this car will make 50 m.p.h.

MUFFLER CONSTRUCTION

Q—Publish diagram and explain operation of a muffler that is as noiseless as possible and yet will not cause excessive back pressure.

2—How are mufflers on the better cars, such as Marmon, Packard, Cadillac, etc., constructed that allow them to quiet the explosion?—E. A. Fisher, Lima, Ohio.

1—There are numerous and diverse ideas incorporated in the designing and manufacture of mufflers, but a good idea of their construction can be obtained by observing Fig. 5. In the first instance, a shell of sheet iron, similar to stovepipe, is used for the outer casing. Ends of cast iron plates would be provided, held together by long bolts and also by the screw caps designed to hold the ends of the pipes, one leading from the engine and the other to the air. A pipe running through the center can have a partition welded in the center and each half will be drilled with holes, about $\frac{1}{4}$ in. in diameter. The exhaust enters the forward end, passes out of

the pipe inside the shell and into the space around the holes. Then it will find its way into the holes in the other end of the pipe and out into the air. This roundabout course forced upon the exhaust gasses will break up the noise effectually.

The type shown in the second figure is of similar design, worked out a little differently in that the gasses are forced into perhaps another passageway and are broken up a little more, but the general scheme is followed out in effect. So far as a muffler is concerned it is simply any means of diverting the gasses so they lose their force and are thereby smothered. To avoid back pressure means making plenty of allowance, by size, to permit the gasses to escape without undue friction.

2—It is very probably that each of these cars has a muffler design of their own. The Marmon uses a muffler which is simply a long nest of pan-shaped stampings having different size and shape openings in the base through which the gasses must pass, and in so doing the explosive force is prevented from causing noise when coming into direct contact with the outer air.

CONNECTING VACUUM GAGE

Q—Explain method of connecting a J. A. Y. vacuum gage to a Stewart vacuum tank.—Morice Krikeeng.

Remove plug W indicated in Fig. 3 and connect a line that will run to the dash. The gage can be connected in this line at a convenient point.

GASOLINE

Q—What test gas gives the best results in Model T Ford 1917 engine, regular Ford carburetor.—J. G. Gilchrist, Hot Springs, S. D.

There is too much latitude in the meaning of the term "best results" to venture an opinion that will be satisfactory to either person in a dispute or

misunderstanding. The higher grade or lighter fuel will make a snappier, cleaner engine and will be good for racing purposes; it will not, however, give anywhere the mileage the lower grade will give. The latter has more heat units and consequently will give more power for a given quantity, but at the same time it will not permit as easy starting and will cause greater carbon deposits than the lighter fuel. Once the engine is warmed it will work with ordinary satisfaction. In either case a great deal depends upon the carburetor adjustment, condition of the engine, ignition and other things. However, as a rule, it may be stated that the lighter fuel will produce easier starting and will make a snappier engine, whereas the heavier gasoline will give more power and also cause greater trouble in starting and more carbon deposits.

CHEVROLET DIFFERENTIAL

Q—Give the name and address of the manufacturer of the LaFayette car.

2—Can the spiral differential gears be used in the Chevrolet 490 in place of the regular straight gear? Where can they be secured?—B. A. Liehr, Versailles, Ill.

1—The Lafayette Motor Co. is located at Indianapolis, Ind.

2—We are advised that these gears are not made interchangeable; besides, you will gain so little advantage that it will not pay to attempt the change. It never pays to attempt to alter design.

STROMBERG GASOLINE LEVEL

Q—What is the gasoline level on a Stromberg model G No. 2.—J. B. Jones, Gordonville Garage, Gordonville, Tex.

As a rule the correct height for the gasoline level is marked on the glass and you can probably find this mark. If not, see that the float is set so the line is about $1\frac{1}{2}$ in. from the bottom of the carburetor; in other words, it will be almost as high as possible without leaking.

HENDERSON MOTORCYCLE

Q—What is the bore and stroke of the latest type Henderson 4-cylinder motorcycle?—Joseph Ruzicka, Chicago.

1—Several sizes of Henderson motorcycle engines have been manufactured. In 1914 the size was $2\frac{5}{8}$ by 3 in.; in 1916 and up to 1918 there was a size measuring $2\frac{17}{32}$ by 3 in., while the latest type, Z, has a bore of $2\frac{3}{4}$ and a stroke of 3 in.

TIGHTENING MAIN BEARINGS

Q—Is it advisable to punch the outside of the main bearing caps in tightening same?

2—Describe and illustrate the proper surface of a valve face and seat to be attained when ground.

3—Give firing order of an Allen 41.—Lee Bivans, Latour, Mo.

1—It is not advisable to punch the outside of the main bearing caps to tighten them, as it will result in causing high spots on the bearings and irregular wearing as well. A good method is to remove the cap and file it as shown in Fig. 6. This will enable you to get the same tightening effect and still maintain a uniform surface of the bearing.

2—A valve seat when properly ground should have a polished mirror-like, even

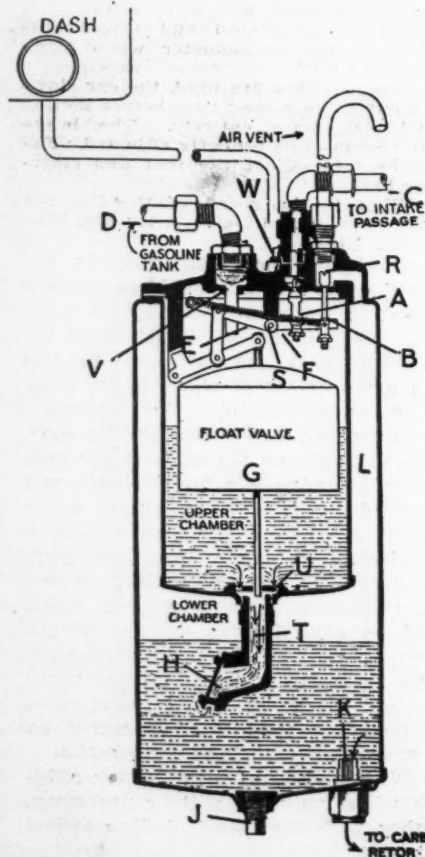


Fig. 3—Cross section of Stewart vacuum tank showing connection for vacuum gage

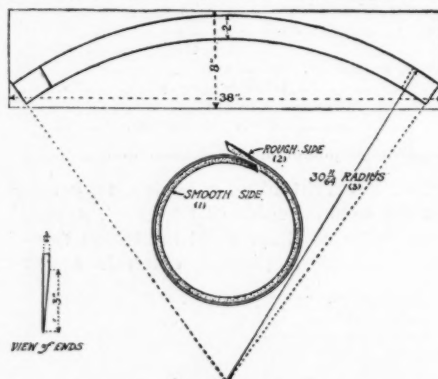


Fig. 4—Pattern for cutting clutch leather for the Overland cone clutch

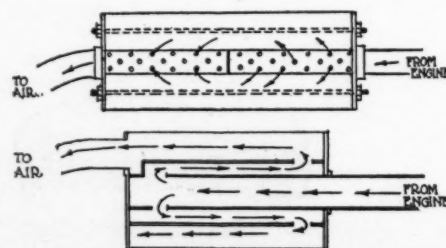


Fig. 5—Two kinds of muffler design showing the flow of the gas

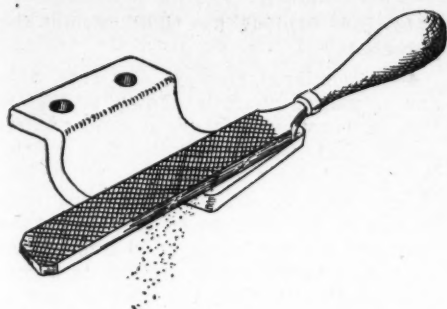


Fig. 6—Filing a bearing cap

grey surface. If any marks are noted on the valve seat it is an indication that there are pits in the surfaces. If when the valve is revolved and then removed it is found that the marking has been rubbed off, it indicates a good sur-



Fig. 7—Properly ground valve and valve seat

face. Fig. 7 shows proper surface of valve and valve seat when correctly ground.

3—The firing order of an Allen 41 is 1-2-4-3.

AXLES AND GEARS

ADJUSTING GEMMER STEERING GEAR

Q—How is lost motion taken up on a Gemmer steering gear in a 1917 model 21 Hal Twelve?

2—How many pounds compression per square inch should a 27/8 by 5 cylinder on a Weidely 12 engine have?

3—Do you know if the Weidely 12 engine in the Singer 20 uses an improved gas intake manifold heating device over that used in the same engine in the Hal 12?—Harry T. Baxter, Nauvoo, Ill.

1—The Gemmer steering gear is illustrated in Fig. 11 and the position of adjustment is shown. To correct play in the steering gear, block the front wheels of the car clear of the floor so the weight is removed from the front wheels and they can be moved readily with the steering wheel. With the steering wheel turn the wheels to the extreme right as though about to turn a sharp corner. There is less wear at the angle positions than at the straight-ahead position, and a tight adjustment straight-ahead probably would be a binding adjustment in the angle positions.

In the extreme position work the steering wheel slightly to ascertain the amount of backlash or lost motion. If the steering column moves up and down, loosen the clamping bolt in Fig. 11 and slowly turn down the nut until all the end play is eliminated. Then tighten the clamping bolt. If lost motion of the steering wheel is still excessive, examine the cross tube and reach rod connections for wear, also steering arm, as it may be that it is loose on the worm-shaft.

If this does not prove entirely satisfactory, it is an indication the teeth on the worm wheel and worm gear are worn. This can be corrected immediately by turning the worm wheel a quarter way around, thus presenting new sets of teeth to engage with one another on both the worm wheel and the worm gear. This adjustment can be made as follows: Loosen the clamping bolt, Fig. 11. Remove the steering arm. Turn the steering wheel a quarter around and replace the steering arm and clamping bolt. This will present the engaging of entirely new sets of teeth on the worm wheel and worm gear. It is not advisable to try to

adjust the steering wheel absolutely without backlash. Too much rigidity will result with undue wear and with unnecessary difficulty in steering.

2—Yes, the Ford Motor Co. make a six-cylinder car. In design, the six was very much similar to the present four. The ignition was by six separate battery coils, just as the present car has four coils.

3—A custom-built car is one where the body is made to meet the individual demands and tastes of the purchaser. In general, this is the full extent of a custom builder's purpose.

2—The compression per square inch is about 70 pounds.

3—We cannot state whether the manifold heating device is better in one car than it is in another. You will have to obtain information as to the claims of these companies and make your own decision.

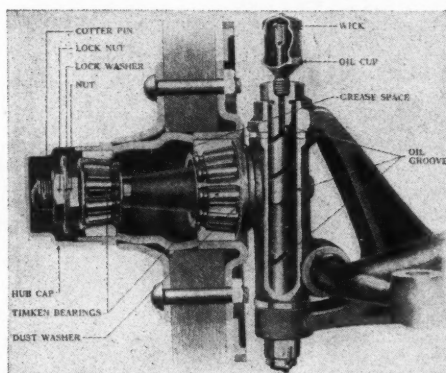


Fig. 8—Cross sectional view of Studebaker steering knuckle

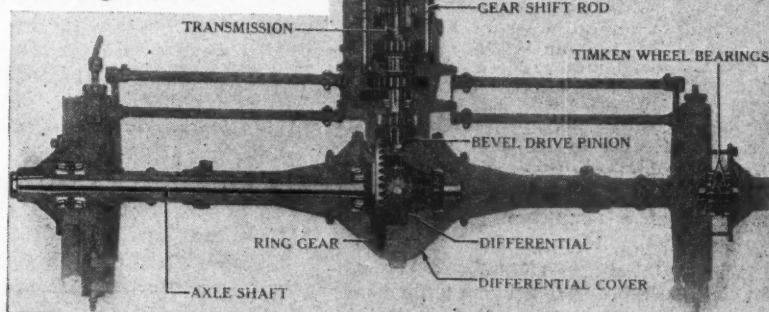


Fig. 9—Cross sectional view of Studebaker rear axle and transmission assembly

STEERING SPINDLE ADJUSTMENT

Q—How can one prevent grease in the left rear wheel of a 1916 Studebaker Four from leaking around the brake drum and over the wheel?

2—Explain how to remove, take apart and clean the horn motor?

3—Explain how to remove the front steering spindle bushings?—J. R. Refaum, Buffalo, N. D.

1—The axle used on this car is of the floating type, and you can probably overcome the oil leaking difficulty by installing a felt spiral around the axle shaft, in a direction counter to the forward rotation of the shaft. This will serve to throw the oil back into the differential chamber which will prevent its leaking out at the brake end.

2—The make of horn used on this car is not known, but the operating of taking it apart and cleaning is simply a matter of removing the small screw at the back of the motor part of the horn which releases the cover over the motor and diaphragm. The cleaning operation should be confined to trimming up the brushes and cleaning the surface of the commutator. The horn is shown in Fig. 10.

3—A sectional view of the steering spindle and axle and wheel hub is shown in Fig. 8. The task of removing the spindle bolt is a progressive one in that a nut is removed from the bottom, the bolt then lifted out and the wheel next slipped off. The tie rod, of course, must be disconnected before the spindle bolt is taken out.

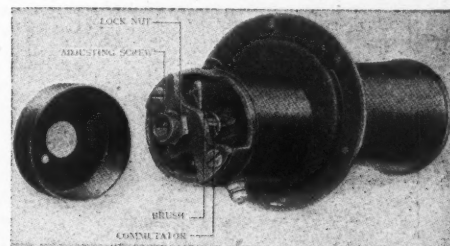


Fig. 10—Assembly of horn used on Studebaker

REFACING OVERLAND CLUTCH

Q—Instruct how to reface clutch on an Overland 90.—Carl F. Mix, Clear Lake, Minn.

1—If it is impossible to secure satisfactory operation of the clutch by adjustment, it will be necessary to renew the clutch leather. Before installing a new clutch leather soak it in Neat's Foot Oil and then stretch it tightly over the clutch cone. The spring plungers should be drawn below the surface before the leather is placed in position. The rivets used in installing the leather must be driven well below the surface of the leather.

When needed, it is the best policy to obtain a new clutch leather from the Willys-Overland dealer, but when the clutch must be relined in an emergency a new facing may be improvised from

a piece of first-class unstretchable leather belting $\frac{1}{8}$ of an inch thick.

The leather should be first cut as shown in Fig. 4. Then place the leather over the clutch cone in the correct position and draw it as tight as possible. The leather, if cut as shown, will lap from 3 to 4 in. Mark on the inner side of the lapped leather the end of the first turn which lies against the cone. Next remove the leather and measure back or toward the long end of the leather $\frac{5}{8}$ of an inch. Measure back from the unmarked end of the clutch leather 3 in. and bevel the leather off as shown in Fig. 4; add 3 in. to the corrected length of the leather and bevel this end as shown. The leather may now be cemented and after it is thoroughly dried may be installed as is one of the standard made up leathers shipped from the Overland factory.

QUESTIONS ON ENGINES

PROBABLY HEAVY FUEL KNOCK

Q—What causes a muffled pounding knock, at engine speed, in a 1916 Studebaker four. The pound is loudest at 23 m.p.h.; it cannot be heard at 15 m.p.h. or slower, nor at 30 m.p.h. or over.

2—The exhaust valves are so badly warped they will not clear the valve cages. Explain how they can be removed.

3—Why does the engine crack the

in a guide as shown in Fig. 15. If the valve stems are so badly warped that the valves cannot be removed by pulling them out through the guide then we advise making a U-shaped spacer to place around the valve stem as shown. Now by hammering on the top of the valve the U-shaped spacer will force the guide downward. By building up on the

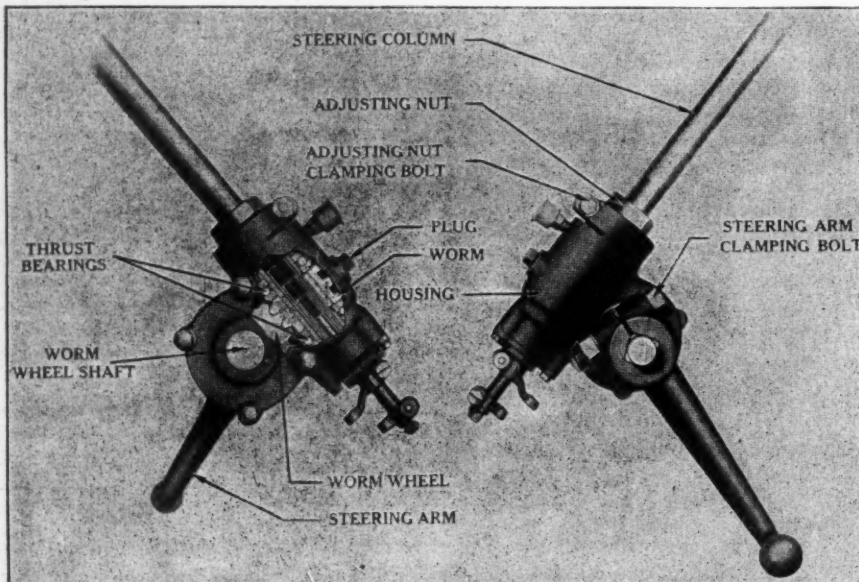


Fig. 11—Gemmer steering gear assembly on Studebaker showing parts for adjustment

Tungsten heavy duty plugs in about 50 miles?

4—What adjustment of the propeller shaft, where it enters the transmission case, would eliminate an annoying rattle caused by too much play?

5—The speedometer chain breaks constantly and it is almost impossible to turn the clutch at the head. What is the cause?—J. R. Rafaum, Buffalo, N. D.

1—From your description we are inclined to believe that this is a fuel knock. The description adequately describes such a condition. If the knock occurs during the confined limits of speed as stated when rapidly accelerating it is possible that a loose main bearing is producing the knock.

2—The valves in this engine are set

height of the spacer the guide can be forced down and out through the bottom while the valve stem will be forced out of the guide. If the stems are so badly warped that great pressure is necessary to remove the valves it may be necessary to secure new valve and guides in order to obtain perfect operation.

3—It is possible that faulty carburetion is causing the spark plugs to crack. If the mixture is too rich undue heat will be caused, which is apt to cause the plugs to crack if the engine is raced from a cold start. There is also a possibility that the spark plug shell and

flange are bearing too tight against the porcelain.

4—A sectional view of the rear axle and propeller shaft is shown in Fig. 9. You will note that there are no adjustments that will eliminate this rattle, which we believe is caused by either one of two things. The shifter rods may be one of the sources of trouble or the bushings on the cross of the universal joint may be the other. There is a further possibility that the torque rod is slightly loose, which might produce this rattle, but since the torque rod is secured by three lock washer set bolts this cause is more remote than the others.

5—The speedometer swivel is probably causing the trouble and since these are rather difficult to repair we advise that you send it to the Stewart Speedometer Company, Chicago.

GYRO ROTARY ENGINE

Q—Publish valve setting of the 1914 six-cylinder Stutz, and the 1916 six-cylinder Oakland.

2—Illustrate a rotary engine, showing how the gases are taken into the combustion chamber, and how the exhaust gases are carried off; also state whether two or four cycle.—H. S. Brown, Newark, N. J.

1—The valve setting of the 1916 six-cylinder Oakland is as follows: The intake opens 17 deg. 30 min. after upper dead center and closes 38 deg. after lower dead center. The exhaust opens 42 deg. and 5 min. before bottom dead center and closes 7 deg. and 30 min.

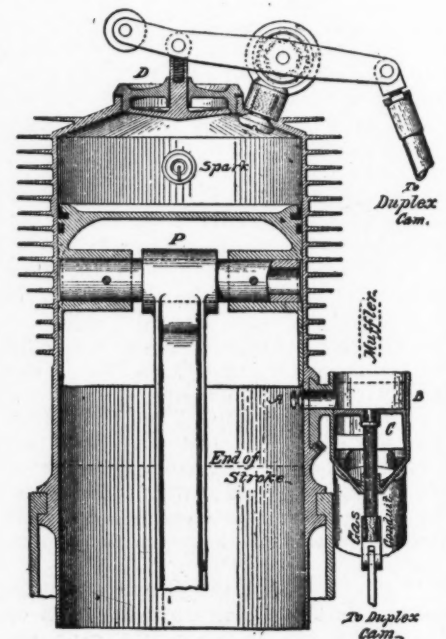


Fig. 12—Cross section of one cylinder of the Gyro rotary engine, showing means of intake and exhaust

after top dead center. We have no valve timing information on the 1914 six-cylinder Stutz.

2—The "Gyro" Rotary engine, an American seven-cylindered air-cooled rotary engine is shown in external view in Fig. 13.

The cylinders are of 3 per cent nickel

steel, with the exhaust valves in their heads operated by push-rods and rockers; the pistons are of steel, with two rings, as in the normal Gnome engine already described. The crankshaft is of nickel-chrome steel, carried in ball bearings within a thin crankcase of vanadium steel; the crankshaft is, of course, fixed, and the crankcase and cylinders rotate around it.

The inlet valves were at first located in the piston crowns, as in the Gnome engine, but were actuated in a special manner; in the 1914 design, however, these inlets were abandoned and replaced by the device diagrammatically shown in Fig. 12.

This consists of a cam-operated piston valve C working within a cylindrical casing B, which communicates with the cylinder by means of ports A, overrun by the working piston. The top of the casing B communicates with the exhaust pipe, or directly with the atmosphere, while the bottom is connected to a supply of super-rich carbureted air contained in a casing on the opposite side of the crankcase.

During the working stroke of the power piston P, the piston valve C is moving downward, so that when P overruns the ports A, the valve C is in the position shown in Fig. 12; the bulk of the exhaust gas immediately escapes through the ports A, via the top of B, into the atmosphere. It will be noted that a silencing apparatus can readily be applied to this portion of the exhaust.

The subsequent up-stroke of the power piston P scavenges the remaining burnt gases through the now lifted exhaust valve D. During part of the following suction down-stroke of P the valve D remains open, thus admitting fresh air to the cylinder; D is then closed, and the continued descent of the piston P creates a partial vacuum above it, so that when the ports A are overrun a rich mixture enters by way of the lower part of the casing B, as the piston valve C has by then moved to the top of its stroke, thus connecting the ports

A with the supply of richly carbureted air. The rich mixture mingles with the air already in the cylinder in the correct proportion to form the explosive charge of the next working stroke.

The ascent of the piston next compresses this charge, which is then fired as usual; the engine thus operates on the four-stroke cycle with only one valve, viz. D, exposed to the pressure of the explosion.

By the adoption of the valve C an auxiliary exhaust is obtained without any risk of affecting the carburetion, and as the ports A serve both for exhaust and admission, overheating of the cylinder walls in their vicinity is avoided. The exhaust valve D—usually the hottest part of the engine—is here not only relieved of the duty of passing out the bulk of the exhaust gases, but is also kept cool during running by the periodic inflow of fresh air to the cylinder as described. As already pointed out, the major por-

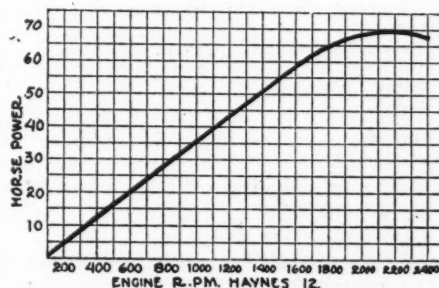


Fig. 14

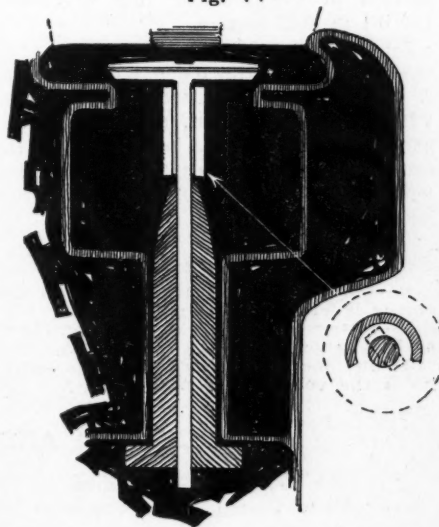


Fig. 15—Cross section showing how the valves in a Studebaker engine are set in the guide, and a U-shaped spacer which can be placed around the valve stem to aid in removing the valve

tion of the exhaust issuing from the top of B can be easily silenced, but it is obviously impossible to apply any silencing device to the exhaust valves D.

If rotary engines are of the two-cycle type they can be designed with an even number of cylinders, but the four-cycle engines must have an odd number of cylinders.

HORSEPOWER RATINGS

Q—Give horsepower rating of the Overland 4, Dodge, Grant, Oakland and Packard.

2—What is meant by A. L. A. M. and S. A. E. rating?

3—What is meant by model 90 and model 81, etc.?

4—Where can washing soda be purchased?—Clifton B. Norris, Willow Shade, Ky.?

1—The N. A. C. C. horsepower rating of the Overland 4 is 18.23 hp.; the Dodge 24.03 hp.; Grant, 21.6 hp.; Oakland, 18.97 hp. and the Packard, 43.2 hp.

2—The A. L. A. M. refers to the Association of Licensed Automobile Manufacturers and the S. A. E. to the Society of Automotive Engineers, and the formula is the same for both. This formula, which is bore squared times number of cylinders times the constant four-tenths, is now called the N. A. C. C. Formula.

3—Model 90 refers to the model number of the car manufactured by the Overland company last year.

4—Washing soda can be purchased at any grocery store.

HAYNES 12 POWER CURVE

Q—Publish power curves of the Haynes Six and Twelve.—Reid Hanselab, Dennis, Kent & Horn, Duluth, Minn.

Power curve of the Haynes 6-cylinder engine appeared in the April 1 issue of MOTOR AGE. Haynes 12 power curve is shown in Fig. 14.

FORD ENGINE COUNTERWEIGHTS

Q—In welding counterweights on a Ford crankshaft, what should each one of the weights weigh?—E. J. Oliver, Chicago, Ill.

We do not advise welding counterweights to a Ford crankshaft inasmuch as you are too apt to distort the shaft and ruin it. Again, you can not have

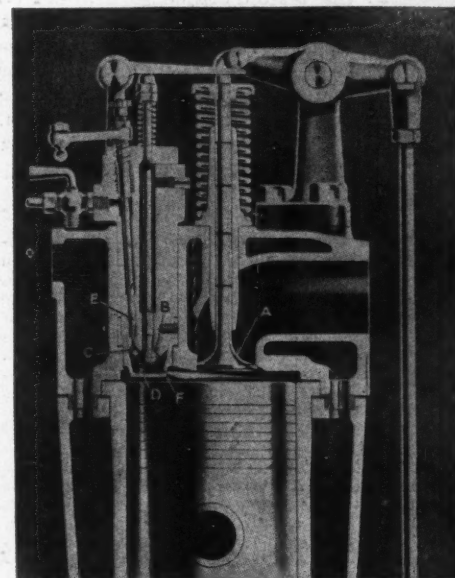


Fig. 16—Cross sectional view of the Hvid engine

the heat equal in all cases and this will not work to the advantage of the metal. It is not necessarily a question of weight, but rather of weight combined with shape and length and this is something that will have to be worked out. There are several concerns making just such weights, ready for use, and it will

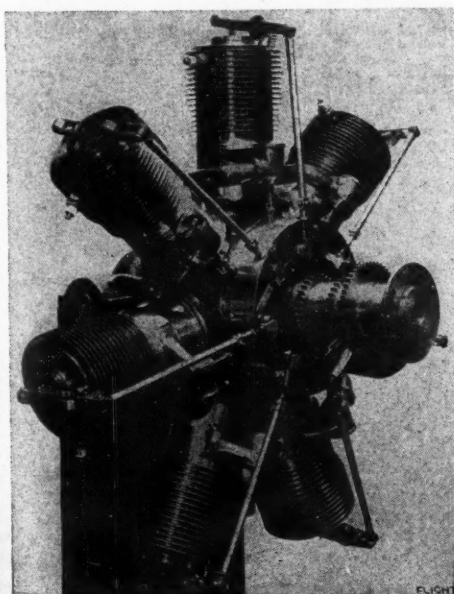


Fig. 13—Gyro 7-cylinder rotary engine

prove more satisfactory and be cheaper to use these. You can find them advertised in *MOTOR AGE*.

VALVE TIMING

Q—Publish valve timing for racing engine of 2600 r. p. m.? Also give the valve timing of some of the A. A. A. racing cars if possible.—L. V. Willard, Ponca City Machine Shop, Ponca City, Okla.

You have told us nothing about the design of the engine you intend using and this will have an important bearing on the case, to say nothing of size of valves, nature of ignition, length and size of manifolds, carbureter, etc. A haphazard guess is all that can be made under such circumstances. A good racing camshaft will result from a design whereby the inlet will open at 10 deg. past center and close at 50 deg. past bottom center, having the exhaust close at 10 deg. past top center and open 50 deg. before bottom center.

The Essex timing is as follows: The intake opens 7 deg. after upper dead center and closes 42 deg. after lower dead center. The exhaust opens 55 deg. before bottom dead center and closes 8 deg. after top dead center.

This is about as near racing form as can be made.

WRISTPIN OFFSET

Q—Why is a Buick wristpin offset in the piston?

2—Where does the explosion take place at high speed and under a heavy load?—W. B. Balmer, Industry, Ill.

The pin is offset to compensate for the difference because the thrust is greater when the explosion occurs than it is on the compression stroke.

2—The actual explosion takes place just as the piston begins to descend on the working or power stroke. The spark is advanced or retarded in accordance with the engine speed—to make up for the difference between the time of the spark and the position of the piston, inasmuch as there is some time elapsing during the propagation of the gases.

KNIGHT ENGINES

Our attention is called to the statement made in *Motor Age*, March 11, in the Readers' Clearing House, page 48, under the head Knight Engines. The statement made shows the percentage of Knight engine application to the number of chassis models, is on the decrease. There are fewer chassis models being produced with Knight engines this year than last when compared to the total number of chassis models offered. The fact of the matter is that the great number of assembled cars which are made from standard parts are of the poppet valve type, whereas there is no parts maker that we know of furnishing a standard Knight engine for assembled cars. As far as actual production is concerned all the concerns making Knight engine cars are scheduled to produce anywhere from one and one-half to two times as many cars this year as they made last year.

WHITE COMPRESSION RELEASE

Q—Illustrate the compression release on the White.—R. F. Dickson, Kansas City, Mo.

We have no illustration to show the compression release on the White.

The release handle is attached near

the fan and there is a cable that runs to the rear end of the camshaft through which the device operates. The camshaft works through a spring and this allows the release to move the camshaft backward and forward. When the release is in operation the camshaft is in a position that holds the exhaust valves open at all points of the cycle.

PISTON SLAP

Q—I have a Chalmers rebuilt car and cannot determine what kind of an engine it has. It is a four-cylinder, L type engine and has a big screw plug and a spark plug over each valve. The valves do not set down in a groove, but are on a flat surface. There is a big plug with priming cock directly over the piston of each cylinder. The fly wheel is not enclosed. It has a cone clutch and the gear box is under the front seat. A gear oil pump is placed in the crankcase, which is very low. The water pump and magneto are on the left hand side and the carbureter and exhaust pipe are on the right hand side. You published a picture of the Chalmers car in *Motor Age* some time ago, but it was nothing like the car described above.

2—Has the 1917 Stevens a gear oil pump?

3—What does a Ford piston slap sound like?—R. B. Biggs, River Road Garage, Tiffin, Iowa.

1—As far back as 1911 Chalmers, according to our records, inclosed the flywheel of the engine. So, unless this engine has been rebuilt with the housing of the flywheel removed, the engine must date prior to 1911.

2—An eccentric operated by a cam on the camshaft produces a reciprocating motion of the plunger that circulates the oil in this engine.

3—Depending upon the intensity of the piston slap the noise will sound as if the piston itself were being struck with a wooden mallet, and as the slap grows worse it might be likened to the noise produced by striking the piston with a mallet made of soft metal like lead.

HVID OIL ENGINE

Q—Explain the mechanical movements of the Hvid oil engine fuel valves.

2—Is the valve B simply a ball and socket valve?

3—On the compression stroke what holds the valve in its seat firmly?

REBUILDING AND SPEEDSTER DESIGNS

CHANDLER SPEEDSTER

Q—Publish sketch of a Chandler 18 chummy speedster. Two separate seats in front, a space wide enough between same to get into rear seat for two or more. Cover for rear end to give the appearance

4—If on an experimental engine the holes in the emission cup are made too large, what additional piece would be necessary? In other words, is the entire cylinder head and emission cup integral?

5—What is the fuel feed, suction or gravity?

6—On what theory is the size of the emission holes reckoned?

7—Of what kind of metal is the fuel valve made?—Russell J. Walters, Quincy, Ill.

1—The Hvid engine operates on the four stroke cycle principle. A cross section of the engine is shown in Fig. 16. Pure air only is admitted through the inlet valve A during the suction stroke. While the cylinder is being charged with air, the fuel valve B is opened and fuel is admitted to the steel cup D through the opening C, the amount of fuel entering being governed by the needle valve E. The valve B closes and seals the opening C at the end of the stroke.

The compression stroke follows and the air in the cylinder is compressed to about 380 lb. per sq. in., which renders it nearly incandescent. The air being raised to a high pressure and temperature enters the cup D through the small holes F, equalizing the pressure within the cup due to combustion, and the fuel which is thoroughly heated and atomized is forced out through the small holes in the cup and coming in contact with the heated air in the cylinder, it ignites and burns. The power and exhaust strokes follow in order as in the conventional four-cycle engine.

2—Valve B is not exactly a ball and socket valve, but is really a part of a one.

3—On the compression stroke valve is held at its seat by the spring and also by the actual force of the compression working against the valve.

4—We have no details on the assembly of this engine and do not know whether the cylinder head and emission cup are integral or not.

5—The fuel feed is gravity.

6—The size of the emission holes governs the timing of the engine.

7—The metal of which the fuel valve is made is a steel, but we have no information as to its composition.

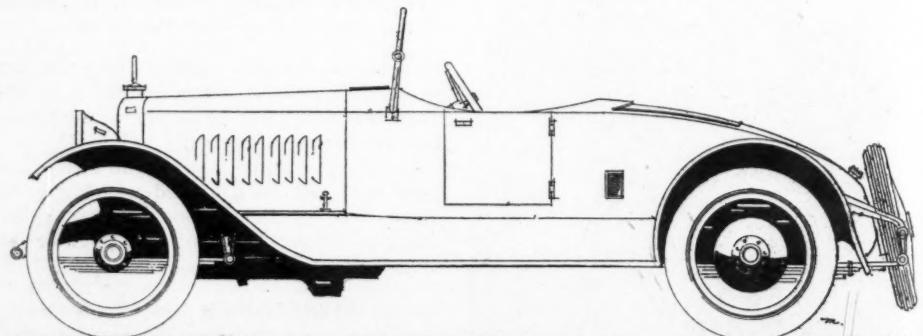


Fig. 17—Suggested design for remodeling a Chandler

REBUILDING OAKLAND

Q—Where can parts for a 1912 Oakland 40 be secured? Northway engine.

2—What speed was this model capable of going?

3—Would this model be suitable for a speedster? If so, what changes in the engine and gearing are necessary?

4—What dismantling is necessary to gain access to the main bearings? Only the center bearing is visible with the oil pan removed?—K. S. Douglass, Ripon, Calif.

1—Parts for the Oakland can be had from the Oakland Motor Car Co., Pontiac, Mich.

2—This car can obtain a speed in the neighborhood of 55 m.p.h.

3—This model would be suitable for a speedster, but several changes are necessary. The engine used in this car is of comparatively slow speed and it would be well to install lighter pistons and connecting rods to help speed it up. A new camshaft to increase the valve lift will aid greatly in getting your engine to a higher speed. Reduce the gear ratio to about 3 to 1.

4—If a good overhauling job is to be done the proper thing to do is to remove the cylinder block, which will give access to both connecting rod, wrist pin and main bearings.

LYNITE PISTONS

Q—Instead of the Lynite pistons in an Oakland, could light grey iron pistons be used without destroying the flexibility of the engine or injuring the crankshaft? If so, where could I purchase them and what would be the approximate cost?

2—Would power be lost on an Oakland roadster by changing the gear ratio to 3 to 1?

3—If so, what should be the speed of this car with standard equipment, using 32 by 4-in. tires?

4—If the gear ratio were changed, would other changes be necessary?

5—What causes an Oakland engine using lynite pistons to throw oil and foul spark plugs?

6—Give ordinary speed of the four-passenger Hudson phaeton, the Nash Sport, Chandler Sport, and the Maibohm B.

7—What is the price of the 4½x6 Duesenberg engine using lynite pistons?—Edward B. Allen, Manville, Ill.

1—There are several companies that make a business of regrinding cylinders and fitting pistons that are changing some of the aluminum piston jobs back to case iron. However, we do not think that it is advisable to make this change because of the original design of the engine. The design of the connecting rod and bearings is for the use of a lightweight piston. Consequently if heavier material is installed it will cause an ex-

cessive strain on the bearings and will eventually result in bearing trouble.

2—As the gear ratio of the Oakland is now 4½ to 1 a reduction to 3 to 1 would undoubtedly decrease the tractive effort. If this change is made the car ought to be able to make from 65 to 70 m.p.h. under good conditions.

3—A change of gear ratio does not require any other changes.

5—Some cars that are equipped with aluminum pistons have had some trouble with oil getting by the pistons and up into the combustion chamber. This is what is known as piston oil pumping and usually takes place when the engine is cold and the aluminum is not expanded sufficiently to reduce the clearance enough to prevent the oil from getting by. About the only way this condition can be helped is by refitting new piston and rings.

6—The speed of the four-passenger Hudson is about 65 miles per hour, Nash Sport and Chandler Sport about the same speed and the Maibohm about 60 to 65 m.p.h. These speeds of course are just approximate as we believe the most important element in obtaining the speed there is in the car is the personal element or the driver.

7—We are not in a position to furnish prices on an engine and as a matter of fact the price varies a great deal depending upon who is purchasing the engine. You can probably obtain prices from the Rochester-Duesenberg Motor Co., Rochester, N. Y.

REBUILDING FORD

Q—Would a two-pole slate base cut-out electrical switch, with a capacity of 250 volts, 30 amperes, be suitable to install on a Ford between the storage battery and starting switch, as a locking means to prevent theft; or would discharge be too heavy when using starter?

2—What speed should a stripped Ford develop equipped with Roof 16-valve cylinder head, counterbalances on crankshaft, Atwater-Kent ignition, 3 to 1 gears in differential and 31 by 3½ rear tires?

3—Give address of company who might build a special sport body for a Ford.—J. Wylie Candle, Ellsworth, Ia.

1—Placing a switch of the size and capacity mentioned between the storage battery and starting switch as a means of locking the car would be all right and there would not be an excessive discharge when using the starter.

2—A Ford when rebuilt as described should be able to make about 70 to 75 m.p.h.

3—Bodies can be purchased from the

Craig-Hunt, Inc., 910 N. Illinois St., Indianapolis, Ind., and the Paco Manufacturing Co., Peoria, Ill.

THE ELECTRIC SYSTEM

LOZIER DIAGRAM

Q—Publish wiring diagram of a Bosch two-spark magneto on the six-cylinder Lozier. The magneto had a dash coil and switch for starting on battery, also a vibrator on coil.

2—Does the high-tension current go through both sets of plugs in series and return through the other distributor?—E. G. Hager, Kimberly, Idaho.

1—Wiring diagram shown in Fig. 18. According to this diagram there is a battery distributor and a magneto distributor. The spark plugs on the exhaust side are supplied with current from the battery distributor and those on the inlet side from the magneto distributor.

2—See 1.

DRY CELL IGNITION

Q—How could a car using battery ignition be run on dry cells should the storage battery run down? Explain how to hook the dry cells direct to the interrupter or to the ignition.

2—Publish diagrams showing how to wire a Velie Six, Buick Six, and an Overland 90, so they can run without a switch key.—N. J.artin, Rushford, Minn.

1—Fig. 21 shows how dry cells may be connected in the ignition circuit if the storage battery cannot be used.

2—It is largely a matter of trial to determine how an ignition system may be worked without the use of a key. If in the system you mention it is possible to get at all of the connections of the switch, you can see that by trial you can find out what is necessary to complete the circuit that is usually accomplished by switch. In the Fig. referred to in question 1, if you connect the battery to terminal 4 you will have ignition without the use of the switch at all.

INCREASING CHARGING RATE

Q—Instruct increase the generator charging rate on a 1915 Monroe.

2—The generator on a 1920 Maxwell has a sharp ringing sound. The charging rate seems to be correct.—C. H. Gardner, Oakland, Cal.

1—If advancing the brush does not help matters in the way of increasing the charging rate it is suggested that you undercut the mica between the copper bars on the commutator and at the

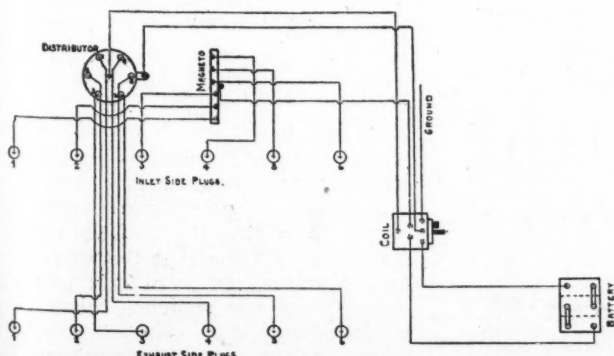


Fig. 18—Wiring diagram of two-spark ignition system used on Lozier

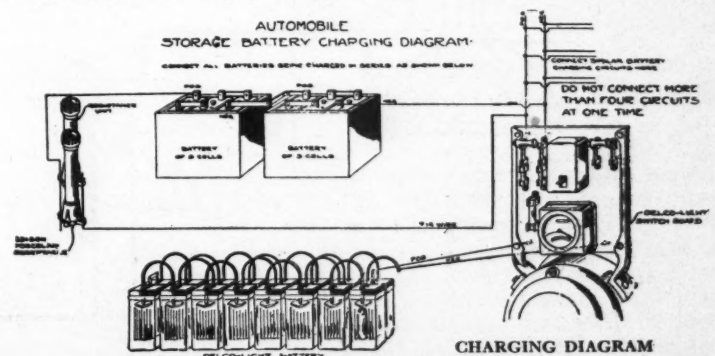


Fig. 19—Diagram showing method of charging storage batteries with Delco light plant

same time clean the commutator and fit new brushes.

2—There is likely to be a broken bearing in the generator or possibly the brushes do not fit as they should. These should be worked in to fit the commutator and if there is no broken bearing the noise should disappear. It is often the case that the brushes are turned about and do not seat perfectly to the commutator.

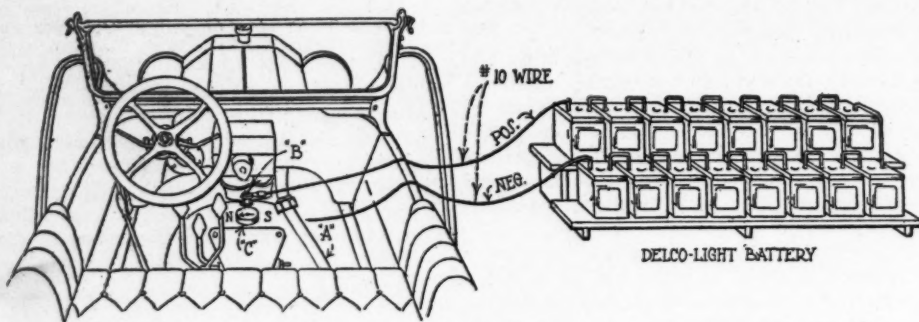


Fig. 20—Diagram showing method of remagnetizing Ford magneto from Delco light batteries

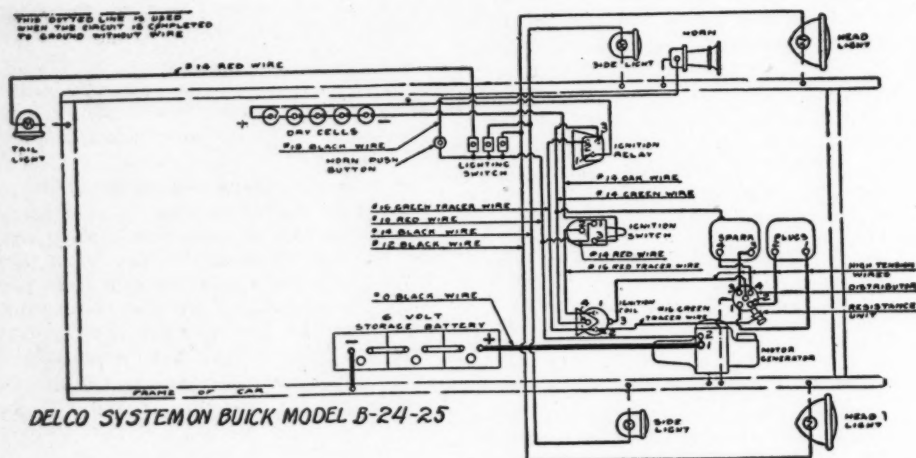


Fig. 21

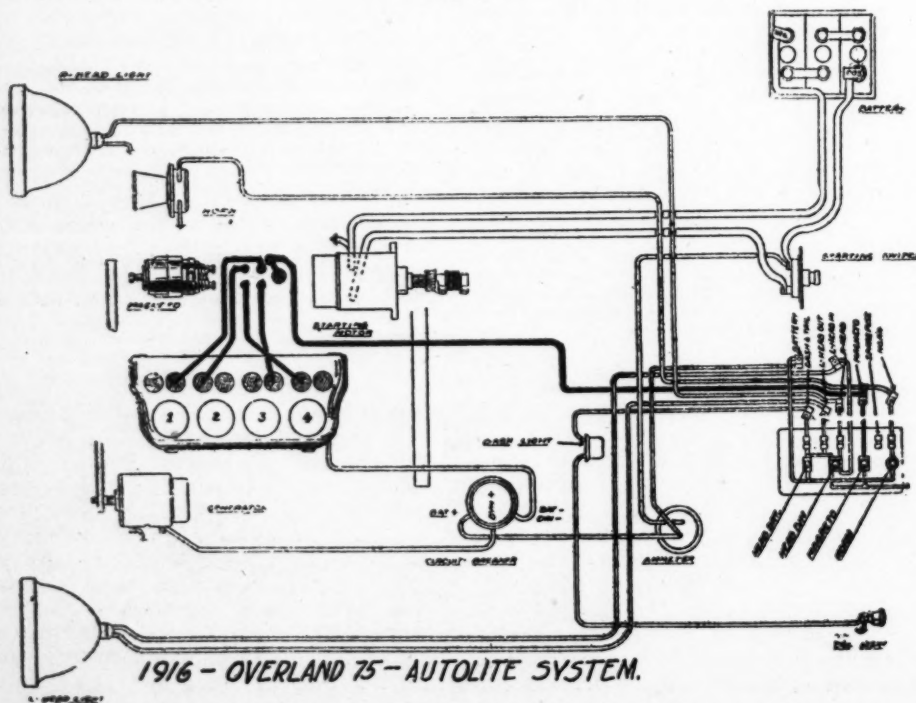


Fig. 22

BATTERY CHARGING

Q—Publish wiring diagram of the 1916 Overland 75.

2—What kind and size of wire should be used for resistance on a 110-volt, 60-amp. Delco plant for charging storage batteries and Ford magnetos?—B. C. Laub, City Garage, Maskell, Nebr.

1—Wiring diagram shown in Fig. 22.

2—The best way to charge one or more storage batteries is to make a lamp bank with the lamps connected in

parallel. Connect this bank in series with the batteries and adjust the charging rate by varying the number of lamps. If 50 watt lamps are used each one will give about $\frac{1}{2}$ an ampere charging rate. The rate of charge should be about 6 amp. to start with and should be reduced to about 2 amp. when the battery is pretty well charged. The Delco-Light manufacturers have a storage battery charging unit which is shown in Fig. 19. It is very inexpensive and the resistance units sell for about \$1.50. The Ford magneto can be remagnetized as shown in Fig. 20. Remove lead from magneto terminal B, Fig. 20. Place a compass C directly behind B and turn engine over until the north pole points to the left when viewed from seat. Connect positive terminal of Delco-Light battery to B and touch for an instant the end lead from negative terminal to some grounded part of machine, as exhaust pipe A. Repeat several times.

GENERATOR WIRES DISCONNECTED

Q—Can a generator be run with the wires disconnected from the terminals? Have been told to connect the two terminals with a wire. This is a Leece Neville generator.

2—The ammeter does not show a charge at any speed. What is the cause of this trouble?—Raymond F. Mausert, Gloucester City, N. J.

1—No; never run the generator with the wires disconnected, for you will burn out the generator. The simplest and safest way to care for this is to remove the brushes and then no harm can be done; otherwise, run a wire from the terminal to the frame of the car.

2—If the ammeter does not show charge when the car is running at 15 m.p.h. or better look for a poor connection, or have the cutout inspected.

FORD IGNITION TROUBLE

Q—There is a peculiar miss in the ignition of a 1920 Ford. The following parts have been replaced with no result: new coil box, commutator wires, secondary wires, commutator, roller, and spark plugs. The spark plug and vibrator gaps have been carefully adjusted. The miss does not appear when the engine is idle or upon acceleration, but it is very noticeable on the road in both forward speeds. On open throttle under load the engine doesn't miss. Have adjusted clutch according to Ford instructions. The proper clearance between the magnets and coils exists. There is no play in the main bearings and no pieces of wire or foreign matter clings to the magnets. Where could the trouble be?—W. H. Ahrens, King's Highway, New Rochelle, N. Y.

If you have gone over the various parts as stated it would indicate too little clearance between the valve stems and tappets, or possibly a sticking valve stem. In setting the clearance give at least .004 in. See that the valve stems are clear and not bent and that each valve spring has sufficient strength. It is frequently the case that sticking valves are the cause of missing and this, as stated, may be due to fouled or bent stems or to weak or broken springs.

Law in Your Business

By Wellington Gustin



AUTOMOBILE HELD TO BE INHERENTLY DANGEROUS INSTRUMENT COURT HOLDS MANUFACTURER LIABLE FOR INJURIES TO PURCHASER OR DEALER REVERSING ITS FORMER DECISION

An important decision has been reached in the United States Circuit Court of Appeals declaring the manufacturers of automobiles directly responsible for injuries to purchasers due to defective materials or workmanship in a car manufactured and sold through the dealers.

This is one of the few cases where a court has reversed itself on the same proposition of law, and the reversal was due to the fact that the wrong rule might well affect many persons adversely and the rule as to the law of the case being largely one of convenience and policy.

The Blank Motor Car Co. sold a car to a retail dealer who in turn sold to the party bringing the action. The car appears to have been fitted with defective wood wheels which broke down, overturning the car and injuring plaintiff to the extent of \$10,000, as found by the trial court. But judgment was refused him because the Court of Appeals had before held that since the purchaser bought from a dealer, there was no contractual relations between purchaser and the manufacturer, and hence no duty owed the buyer by the manufacturer.

The defendant company did not manufacture the wheels, but purchased them from another company. It was found that reasonable inspection and tests to discover the real condition of the wheels had not been used and that the car, when defendant put it on the market, was dangerous to human life and unsafe to use.

Prior to the last appeal of the case, the highest state court in New York, the Court of Appeals, had decided a similar case against another motor car company. That court held that the manufacturer of an automobile is not at liberty to put his product on the market without subjecting its component parts to ordinary and simple tests, and is not absolved from the duty of inspection because it buys the wheels from a reputable manufacturer. Further, it held that the manufacturers' liability was not confined to the immediate purchaser, but extended to third persons not in contractual relations with it.

In its former opinion, the court announced the settled rule of law as being

SEEMINGLY knotty legal problems are constantly arising in the dealer's business, which even a slight knowledge of the law easily may solve. MOTOR AGE presents here the most common legal problems which confront the dealer. Mr. Gustin, a member of the Chicago bar, not only is well versed in the law relating to the dealer, but presents it in such a way as to be readily understood by the layman. In addition to his articles, Mr. Gustin will gladly answer such individual inquiries on knotty points as may be submitted to him.

that one who manufactures articles inherently dangerous, as poisons, dynamite, gunpowder, torpedoes, etc., is liable to third parties when they injure, unless he proves that he has exercised reasonable care with reference to the article manufactured.

But one who manufactures articles dangerous only if defectively made or installed is not liable to third parties for injuries caused by them, except in case of willful injury or fraud.

With the latter class the court included automobiles along with carriages, tables, chairs, etc. Dissenting to this inclusion, Judge Cox, in a dissenting opinion said: "Rules applicable to stage coaches and farm implements become archaic when applied to a machine which is capable of running with safety at the rate of 50 miles an hour."

"I think the law as it exists today makes the manufacturer liable if he sells such a machine under a direct or implied warranty that he has made, or thoroughly inspected, every part of the machine, and it goes to pieces because of rotten material in one of its most vital parts which the manufacturer never examined or tested in any way."

In reversing itself the court has now adopted this dissenting view of the automobile as an inherently dangerous product of manufacture, placing additional duties and obligations upon the manufacturer and making him directly responsible to the public who buys and uses his cars.

And this view has been adopted by the New York court who said: "Beyond all question, the nature of an automobile gives warning of probable danger if its construction is defective. This automobile was designed to go 50 miles an hour. Unless its wheels were sound and strong, injury was almost certain."



NOT RESPONSIBLE IN CASE OF FIRE IF ORDINARY PRECAUTIONS ARE TAKEN

Kindly answer my question in your paper. If automobiles are in storage and in repair rooms for repair and a fire starts, am I responsible for damage if I have signs on the walls not responsible in case of fire?—W. B. Kinn, Effington Automobile Co., New Effington, S. D.

A garage keeper is not an insurer of cars left with him for either repairs or storage. He is only responsible for failure to use ordinary care to prevent loss by fire. This has been defined to be the exercise of such care as he would use in reference to his own property. His responsibility rests upon the question whether he has been negligent in the matter.

Signs disclaiming responsibility would be valueless in shifting responsibility if one is negligent, and if not negligent the signs are unnecessary. One might be negligent either in the starting of the fire or in the saving of the car from the fire. He will be judged by the standard of what ordinarily prudent men would do under the same circumstances connected with any fire that may arise. No amount of signs and notices to the public can change these rules of law.

REFUSES TO RETURN RENTED BATTERY

Battery service station gives rental battery to customer at 25 cents per day until his battery is repaired. Upon opening, battery is found not repairable and customer orders new battery.

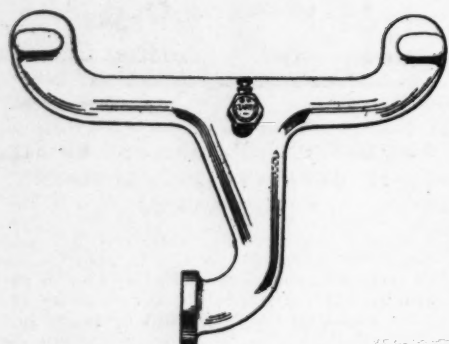
Months have elapsed and customer has not paid rental and refuses to return rental battery. He also makes a statement that as long as rental continues, I should not complain, also wants me to hold new battery as he will come and get it. This he said on several occasions but fails.

How can I obtain my rental battery and rental due? Does this constitute larceny? He has signed no papers.—R. G. Nova, 320 McLean Ave., Chicago.

You may quickly obtain your property by an action in replevin. You should first make a demand for the return of the battery, since your customer came lawfully into possession of the property with no time limit agreed upon for its return. This demand terminates the bailee's right to possession. The replevin action determines only the question of the right to possession. You will have to proceed in another suit to recover the rental due you, if he refuses to pay this, in which suit you may include your claim on his order for a new battery.

The Accessory Corner

New Fitments for the Car



Startit electrical heater and vaporizer to assist starting

U. & J. Ford Carbureter

With the present day grade of fuel the carbureter manufacturer had been up against the problem of producing a design that would properly atomize or vaporize low grade fuel. The U. & J. carbureter is very simple and does not contain a single moving part other than the float and throttle. The manufacturers guarantee it to give the same performance at any altitude or temperature and give more speed and power on less gasoline than required for the average carbureter. Features of its construction are: Single adjustment only; no nozzles or spray jets; automatic control of air intake; plain tube carburetion, no moving parts; complete fittings for replacing stock equipment. U. & J. Carbureter Co., 507 W. Jackson Blvd., Chicago, furnish this carbureter complete to the Ford owner with special aluminum manifold, hot air stove and adjustable dash control.

Save-A-Sleeve Glove

The latest novelty that makes for comfort and economy of the motorist is a Save-a-Sleeve, the new arm length glove, now being offered by the U. S. Glove Co., Marion, Indiana.

Reports indicate this new idea of sleeve protection will prove one of the popular innovations of the canvas glove industry. Just as overalls protect trousers, Save-a-Sleeve is protection for sleeves to shoulder. It is said to be impervious to oil and grease, which offers even a saving in laundry bills, not only for motorists but truck drivers and garage workers as well.

The idea was conceived by Hugh Smaltz, president of the U. S. Glove Co. while on a motor trip last summer, when necessary work on his engine caused him to ruin a coat sleeve with oil and grease.

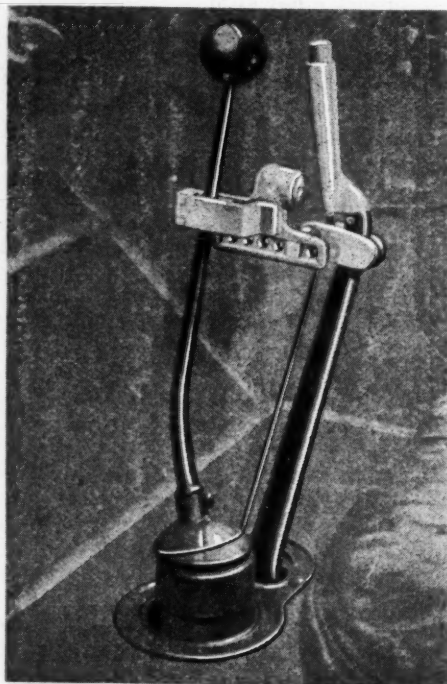
Pep—Self Cleaning Spark Plugs

The Pep spark plug represents a new principle in spark plug development. It has a disk electrode covering the lower end of the plug, giving two inches of sparking surface and the size of the disk causing the electric current to expand gives a greater volume. The results in giving a ring of sparks all around the outer edge of the disk and



Pep self-cleaning spark plug

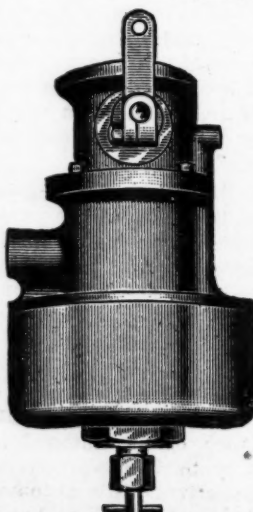
which they claim gives better combustion even on a poor mixture or with a very weak battery. The disk electrode closes the lower end of the plug and aids in preventing oil and carbon from collecting on the lower end of the porcelain. It also keeps the heat and shock of each explosion from direct contact with the porcelain. The Pep Spark Plug Co. of Minneapolis, claim that the plug is self-cleaning because the ring of sparks around the edge of the disk is constantly loosening and burning away any particles of carbon which may form.



Lucia automobile lock holds the gears in reverse and clamps the emergency brake

Lucia Automobile Lock

There are many automobiles stored every day and it is very desirable to have a durable and dependable lock. The Lucia Automobile Lock, made by Lucia Manufacturing Co., New York, is made so as to be attached to the emergency permanently as shown in the illustration and when locked, it fastens gears in reverse position and clamps emergency brake on, making it impossible to drive or tow the car in either direction. It opens with a half turn of key and locks by simply snapping and is built of indestructible drop forgings. The price is \$16.



U & J carbureter for Fords



Save-A-Sleeve glove

Startit

Startit is a simple device, designed to aid the car owner and make the car start easily in the coldest weather. It is an electrical heater and vaporizer made of brass, the walls of which are only ten thousandths of an inch in thickness and the very best grade of resistance wire is used.

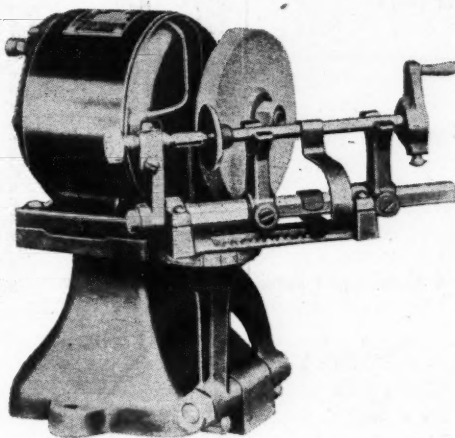
It is easily installed by drilling a 15/32-in. hole and tap out with a 1/4-in. pipe tap near the distributing point in the manifold. Screw in the Startit. A switch is installed on the dash and lamp cord running to the storage battery or four dry cells to carry the current. The device is manufactured by The Pearson-Scott Co., Indianapolis. The price is \$3.

Service Equipment

Time Savers of the Shop

New Motor Driven Valve Grinder

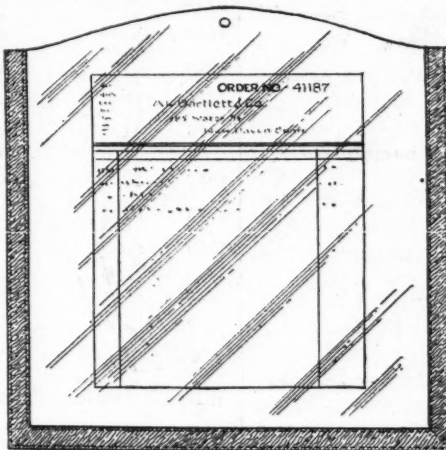
Facing a set of eight automobile engine valves in from 10 to 15 minutes that ordinarily requires from two to three hours to grind in with an electrically driven grinder lately placed on the market should interest every service station mechanic. The machine shown in the illustration was designed primarily for valve facing, but with an extra hub and wheel, it can be used for grinding small tools such as drills and chisels. Simple adjustment features adapt the machine for use with valves of various sizes and shapes. This grinder is manufactured by Westinghouse Electric Mfg. Co., East Pittsburgh.



Motor driven valve grinder

Service Station Order Protector

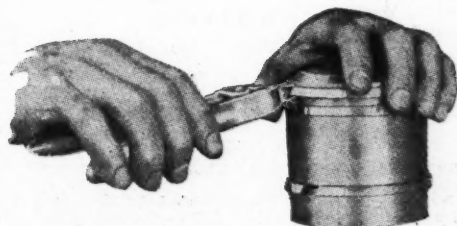
Work orders have a way of being mislaid, soiled and torn on their way to the various service station hands that use them. The illustration shows a practical order carrier and protector, manufactured by the E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del. It is made up of a sheet of transparent material the same as used in auto curtains and a piece of light weight leather substitute which is lapped over on all but the top side of the protector and stitched down forming a large flat pocket, open at the top for the insertion of the order.



Case with transparent front for protecting repair orders as they are handled by the mechanics when a job is going through the repair shop



Polishing and buffing lathe for the needs of vulcanizing and tire repairing. It is reinforced to give added strength and steadiness when running



Hudson piston ring remover to enable the mechanic to quickly remove or replace rings without breaking rings or scoring cylinders

M. K. Shop Press

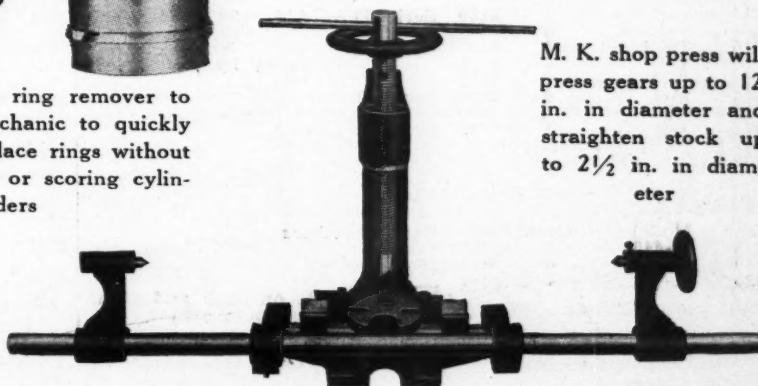
This shop press was designed particularly for work in the garage and automobile repair shop. It will do a great variety of work and with the testing attachment save the time of walking back and forth to a lathe to prove your job and the work straightened in a press more likely to remain straight than when hammered out. The press is powerful and can easily be moved where required. It will press gears up to 12 in. in diameter and straighten stock up to 2½ in. in diameter. Any length of bar can be straightened under this press and special work can be done by replacing the metal blocks with wood or iron blocks of various shapes. The illustrated press is manufactured by Columbia Manufacturing Co., Belleville, Ill.

Polishing and Buffing Lathe

Polishing and buffing lathe shown in the illustration has recently been placed on the market to meet the demands of the vulcanizer and tire repairman. It is of moderate price and many service stations can use them as they will do the work of a regular grinder and at the same time it equips them for tire repair work. Both the stand and the frame are heavy, the frame being reinforced by a double rib which gives added strength and the whole machine steadiness in running. It is built by the Columbia Mfg. Co., Belleville, Ill.

Hudson Piston Ring Remover

The piston ring remover shown is a very simple construction, handy, reliable and cheap. With it you can remove and replace rings quickly without scoring cylinders, breaking rings or cutting your fingers. This device sells for \$1.50, and is manufactured by the Hudson Motor Specialties Co., 1932-34 Arch St., Philadelphia.



M. K. shop press will press gears up to 12 in. in diameter and straighten stock up to 2½ in. in diameter

Passenger Car Serial Numbers

Motor Age Maintenance Data Sheet No. 93

One of a series of weekly pages of information valuable to service men and dealers—save this page

STEPHENS

Year	Model	Cyls.	Price	Serial Numbers
1916	65	6	\$1125	101-1100
1917	65	6	1250	
	75	6	1385	10001-13000
1918	80	6	2050	
1919	82 & 84	6	1975	
	83 & 85	6	3050	15001-20000
	86	6	2050	
1920	80	6	2050	

Number plate on dash, right side, under hood

STEARNS-KNIGHT

Year	Model	Cyls.	Price	Serial Numbers
1912	40	4	\$3500	5000-5875
1913	28-9	4	3750	6000-6412
	42-8	6	4850	8000-8327
1914	Four	4	3750	6500-6800
	Six	6	4850	8328-8728
1915	L-4	4	1750	L1-L702
	Six	6	5000	9000-9109
1916	Four	4	1395	L703-L2800
	Eight	8	2050	10000-10900
1917	32	4	1450	L2801-L4800
	33	8	2150	10901-12000
1918	4	4	1785	4745-5900
	8	8	2575	12079-12350
1919	L-4	4	2250	L5901-L7102
	8	8	2700	12351-12404
1920	4	4	-----	7103 up

Number on dash name plate

STUDEBAKER

Year	Model	Cyls.	Price	Serial Numbers
1913	SA	4	\$885	301501-315611
	AA	4	1290	101501-110614
	E	6	1550	600001-603002
1914	SC	4	1050	403001-420515
	EB	6	1575	605001-612450
1915	SD	4	985	423001-447419
	EC	6	1385	500001-617155
1916	SF	4	885	460001-474180
	ED	6	1050	630001-637260
1917	SF	4	940	474181-500369
	ED	6	1180	100000-109500
				637261-655270
				200000-207500
	SF	4	845	109501-133051
	ED	6	1050	207501-233495
1918	SH	4	895	133101 up
	EG	6	1695	290001 up
	EH	6	1295	233501 up
1919	SH	4	1225	133101-141951
	EG	6	1985	290001-300635
	EH	6	1585	233501-257389
1920	EH	6	1785	257465 up
	EG	6	2550	315701 up

1913 numbers on front seat heel board
1914-15 numbers on front door pocket
1916-17 numbers inside dash
1918-19 numbers under left front fender on frame

STUTZ

Year	Model	Cyls.	Price	Serial Numbers
1912	A	4	\$2000	Series A
1913	4-B	4	2050	Series B
	6-B	6	2300	
1914	4-E	4	2150	Series E (Also 300 Speedsters Series S, built in 1917. Year is indicated by Series letter)
	6-E	6	2400	
1915	HCS	4	1475	Series F
	4-F	4	2275	
	6-F	6	2525	
1916	4-C	4	2300	Series C
1917	4-R	4	2550	Series R
1918	4-S	4	2750	Series S
1919				Data not available
1920				

TEMPLAR

Year	Model	Cyls.	Price	Serial Numbers
1918	A-445	4	\$2185	1-150
1919	A-445	4	2485	150 up
1920	A-445	4	2685	-----

Number plate on dash and right front motor support arm

TULSA

Year	Model	Cyls.	Price	Serial Numbers
1917	D	4	\$1150	3000-3400
1918	D	4	1200	3000-3400
1919	D	4	1200	3000-3500
1920	E	4	1335	4000 up

Number on dash, right side, under hood

VELIE

Year	Model	Cyls.	Price	Serial Numbers
1912	L-M-N	4	\$2200	14001-15999
	W	4	1350	25000-25500
1913	S-T	4	2000	16000-16725
	R	4	1500	30000—(See 5)
1914	6	4	1500	(See R)—31326
	10	4	2000	17301—(See 12)
	11	6	2350	17001-17300
1915	12	4	1500	32101-32500
	14	4	1750	(See 9)—19251
	15	6	2015	19301-19451
1916	22	6	1595	19500-20690
1917	27	6	1065	35000-39000
	28	6	1600	40000—(See 39)
1918	38	6	1185	50000—(See 38)
	39	6	1440	(See 28)—68506
1919	38	6	1695	(See 27)—40987
	39	6	1685	
	48	6	-----	69001 up
1920	34	6	-----	100001 up

Number on name plate left side seat box. Also stamped into top side of frame at extreme right front end; engine number left side crankcase and left hand front motor leg.

WESTCOTT

Year	Model	Cyls.	Price	Serial Numbers
1912	KLM	4	\$1800	
	R	4	2250	
1913	4-40	4	1975	
	6-50	6	2475	
1914	30	4	1385	800-1102
	6-60	6	2485	
1915	O-35	4	1185	1103-1348
	U-50	6	1585	1500-1699
1916	41	6	1295	4001-4200
	42	6	1445	4201-5100
	51	6	1595	4599-5402
1917	17	6	1590	5501-6292
				Number on dash plate
1918	S-18	6	1890	6293-7200
	18-A	6	2290	7201-8088
1919	A-48	6	2590	8101-8904
	A-38	6	1775	10001-10402
	B-38	6	2390	11001-11801
1920	C-38	6	2390	13001 up
	C-48	6	2890	20001 up

Number plate on right side of engine on all cars after S-18

WHITE (Date not available)

WILLYS-KNIGHT

Year	Model	Cyls.	Price	Serial Numbers
1917	88-6	6	-----	1-2500
1917-18-19	88-4	4	-----	1 up
	88-8	8	-----	1-2723
1920	88-4	4	\$1725	

Number plate on right rear frame end; engine number of models 88-6 and 88-4 on plate on left side crankcase

WILLY-SIX

Year	Model	Cyls.	Price	Serial Numbers
1917-18-19	89	6	-----	1-12000

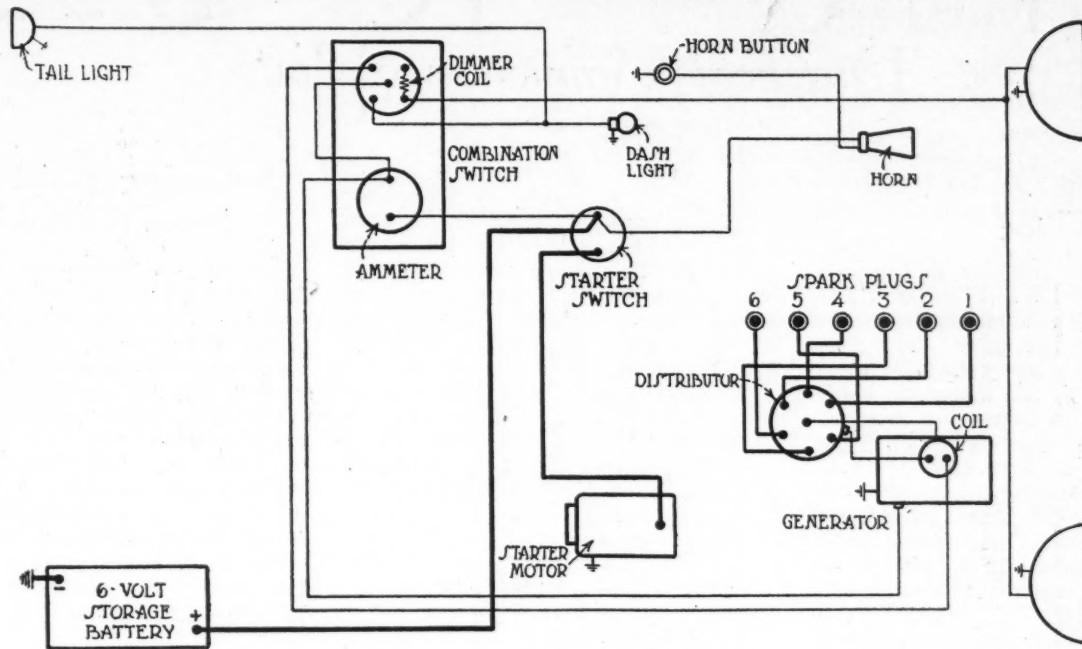
Number plate on right rear frame end

WINTON

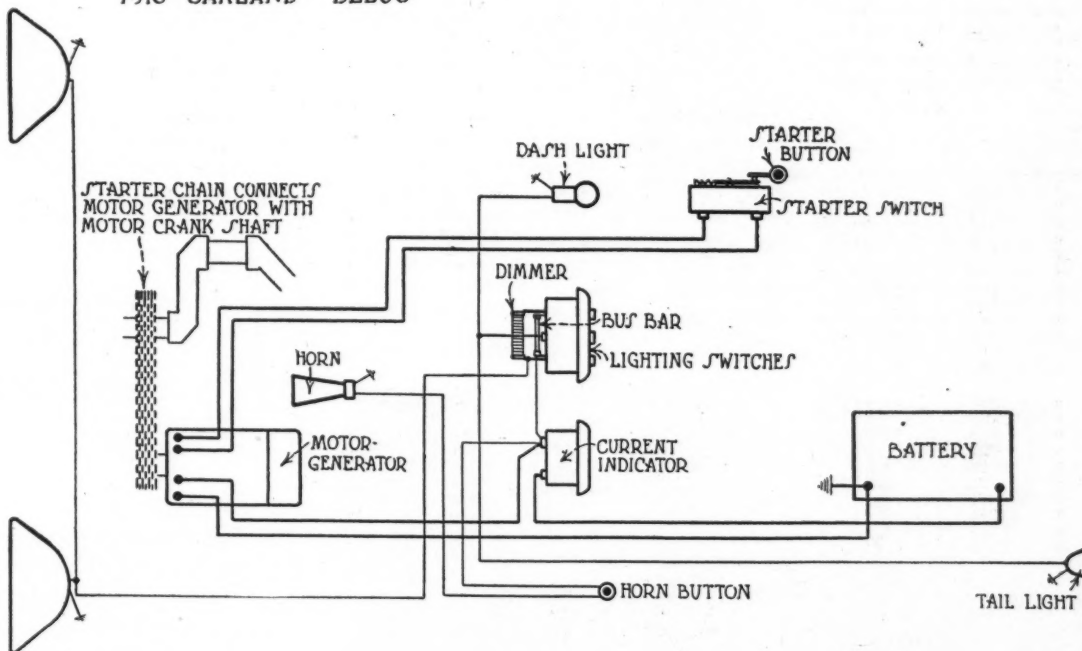
Year	Model	Cyls.	Price	Serial Numbers
1912	17-C	6	\$3000	11216-12482
1913	17-D	6	3250	12490-14757
1914	20	6	3500	15000-16030
1915	21	6	3500	17000-18037
	21-A	6	2435	20000-21300
1916	22	6	3500	25000-25495
	22-A	6	2335	30000-31961
1917	22	6	3500	26000-26612
	22-A	6	2735	32000-33621
1918	22	6	3850	26614-27071
	22-A	6	3200	33622-34169
1919	24	6	4350	28001 up
	25	6	3950	35000 up
1920	25	6	3950	

Number on left front end of crankcase

Motor Age Weekly Wiring Chart No. 73



1918 OAKLAND DELCO



1914-1915 DODGE NORTHEAST SYSTEM

THIS WEEK

1918 Oakland

1914-15 Dodge

Allen—Dec. 18, '19
 Auburn—Nov. 27, '19; April 1, '20
 Briscoe—Oct. 16, '19
 Bulek—Oct. 23, '19
 Case—Oct. 2, '19
 Crow-Elkhart—June 26, '19
 Chalmers—Nov. 27, '19
 Cutting—Nov. 6, '19
 Daniels—Dec. 4, '19
 Davis—Dec. 4, '19
 Dixie—April 1, '20
 Dorris—Dec. 11, '19
 Dort—March 25, '20
 Empire—Oct. 30, '19
 Essex—Oct. 23, '19
 May 15-22, '19

Franklin—June 19, '19; Dec. 11, '19
 General Battery Charging—Sept. 25, '19
 General Magneto Diagram—June 5, '19
 Haynes—Oct. 9, '19
 Hupmobile—Oct. 16, '19
 Internal Connections—July 10-17-24, '19
 Keeton—Nov. 6, '19
 King—July 3, '19
 Kissel—July 3, '19
 Lexington—Jan. 1, '20
 Liberty—Jan. 1, '20
 Marmon—Dec. 25, '19; Jan. 22, '20
 Maxwell—Aug. 14, '19
 Mercer—Aug. 28, '19; Nov. 27, '19; March 25, '20
 Mitchell—Jan. 8, '20
 Monroe—Oct. 30, '19
 Moon—Jan. 29, '20; March 11, '20
 Moore—March 4, '20
 Nash—March 11, '20
 National—June 19, '19; Feb. 12, '20
 Oakland—Oct. 16, '19
 Oldsmobile—April 8, '20

Olympian—Jan. 22, '20
 Owen Magnetic—Sept. 18, '19
 Packard—June 19, '19; July 31, '19; March 18, '20
 Paige—July 3, '19
 Paterson—June 26, '19; July 9, '19
 Pierce-Arrow—Oct. 2, '19; Feb. 5, '20
 Pilot—March 4, '20
 Premier—Dec. 18, '19; Feb. 26, '20
 Reo—Aug. 21, '19; Oct. 9, '19; Nov. 13, '19
 Roamer—March 18, '20
 Saxon—April 8, '20
 Scripps-Booth—Jan. 15, '20
 Stanley—June 26, '19
 Stearns-Knight—Jan. 8, '20
 Stephens—Feb. 12, '20
 Studebaker—Dec. 25, '19
 Stutz—Feb. 5, '20
 Templar—Jan. 29, '20
 Velle—Sept. 25, '19; Feb. 19, '20
 Westcott—Jan. 15, '20
 White—Sept. 25, '19; Feb. 19, '20
 Willys-Knight—Feb. 26, '20
 Special Systems for Fords—May 15-22, '19

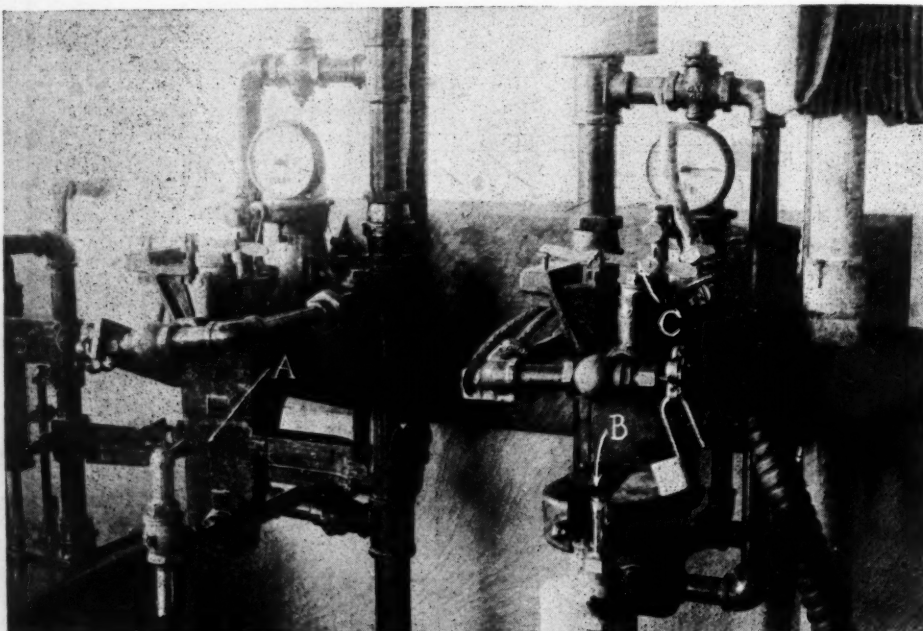
The Automotive Repair Shop

Practical Maintenance Hints

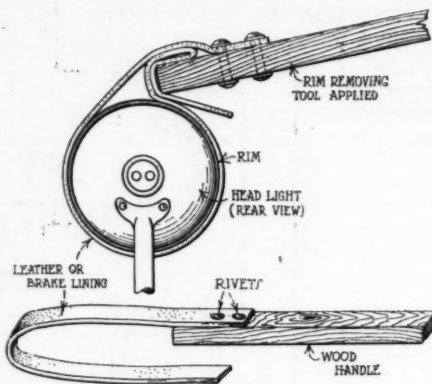
Delivering Oil to Fifth Floor

At the Overland Building in Los Angeles buried under the sidewalk are three 280-gal. tanks for gasoline and two 280-gal. tanks for lubricating oil. Both gasoline and oil are supplied to the second and fifth floors by an automatic electrically operated system. The operator after placing the gasoline or oil hose into the tank turns a dial to the number of gallons wanted. He then touches a lever which starts an electric motor located on the first pump. This motor pumps the required number of gallons and then automatically shuts off. A dial is provided that registers the number of gallons of oil consumed in a month or for any period of time, thus saving a lot of bookkeeping when it is desired to keep an accurate line on the number of gallons used. Another motor and electric control system is provided for the lubricating oil.

If it is not known how many gallons the gasoline tank will hold, the operator simply places the hose in the tank and touches a lever starting the electrically operated pump and when enough has been taken, the operator touches a second lever, which instantly stops the pump, and on a dial will be registered the amount of gasoline or oil delivered.



Automatic electrically operated system for delivering gasoline and lubricating oil to the floors above. The operator places the dial at the number of gallons desired, then touches a button and an electric motor pumps the required gallons and automatically shuts off



Handy tool for removing hub caps, lamp rims, without marring the finish

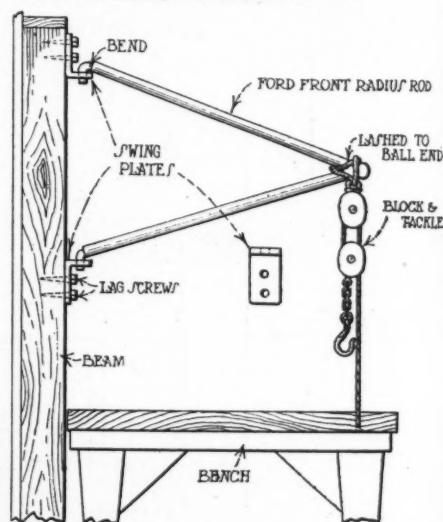
Removing Rear Wheels

Some times the rear wheels on tapered axles defy removal with even the stoutest wheel puller. A local repairman uses this simple method and saves breaking his wheel pullers, also stripping the hub threads. He slacks the axle nut back a turn, takes the car up the steepest grade near his shop at a good clip. Turning he descends the same grade, using the brake several times. The wheel puller is then hardly needed if at all.

Swinging Hoist Made From Radius Rod

A Ford front radius rod, discarded for the reason that the threaded end was broken off, was converted to a swinging hoist support and mounted above a work bench in a local repair shop. It is used to lift the engine from the floor, to the top of the bench and also for lowering the engine. The sketch shows in detail how this feature was constructed and mounted.

The pivoting brackets are bolted securely to the wall beam by lag screws while the block tackle is lashed to the ball end of the discarded radius rod. The pivots permit the hoist to be swung out of the way when not in use.



Swinging hoist made from discarded Ford radius rod to be mounted above the repair bench to lift or lower engines and heavy parts

Tool for Removal of Hub Caps, Etc.

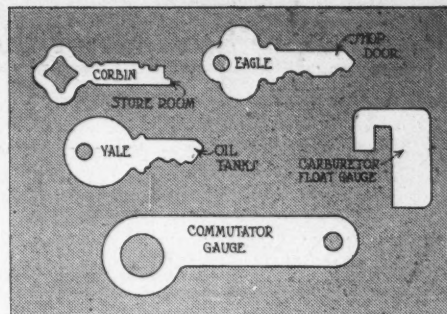
A tool handy for removing hub caps, lamp rims, or other painted or nickel-plated parts, in the garage, is made with a wooden handle and either a leather belt or piece of brake band lining.

The arrangement is shown in the sketch. The most stubborn lamp rim or hub cap is easily removed, depending of course upon the length of the handle.

Brass and nickel-plated pipe can either be held against turning or turned with this tool, without scratching or denting. This feature is a time and temper saver when it comes to removing rusted lamp rims.

Blue Print Copies as Record of the Shop Keys, Etc.

A simple method of obtaining a record of keys to the different locks about the shop or for gages or similar parts that are subject to loss is by means of blue printing them. This record permits of making duplicates immediately without having to call in the locksmith or waiting through a long delay for new gages to be obtained from the manufacturers. The process of making the blue prints is a very simple one. The sensitized paper is obtained from any artist or photograph supply house at a few cents a yard. Place the keys, gages or other parts to be printed on the paper and expose to the sunlight for two or three minutes. Immediately wash the paper in clear running water for ten or fifteen minutes and dry in a shaded place. Place these prints in a desk, drawer where the light is not strong, as too much light has a tendency to fade them.



Make a blue print of keys and gages so when mislaid or lost duplicate can be made without trouble

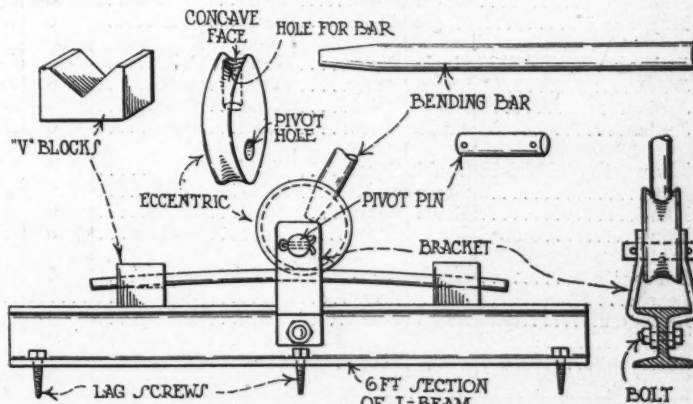
Straightening Shafts, Pipe, Etc.

A 6 ft. section of a 6 or 8 in. "I" beam, forms a rigid base for a serviceable straightening press, that is made as described and shown in the sketch. The "I" beam is drilled for lag screws for bolting to the floor; 4 or 6 5/8-in screws will anchor this beam down securely. Two "V" blocks for positioning the work on the straightener should be made up of steel or cast iron. Two brackets for the eccentric bending bar are made to fit the flanges on the beam securely.

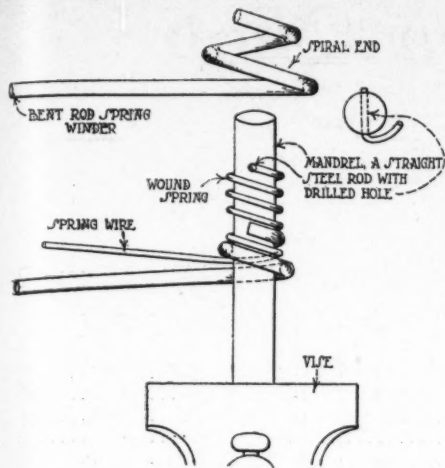
The eccentric is of heavy steel plate, cut circular in shape, about 7 in. in diameter. The circumference of this piece is slightly concave. The pivot is about 1 1/2 in. in diameter and 1 in. off the center of the plate. The eccentric is rotated by a steel bar, inserted into a hole drilled in the rim of the plate. A worn out axle shaft makes a serviceable bar. The manner of using this straightener is obvious, the work is set on the "V" blocks and pressure applied in the reverse direction of the bend.

Improved Surface Plate

A surface plate, while advantageous is almost a luxury to the small shop repairman. A substitute which provides all the accuracy of the cast-iron or steel plate is the face of a ground glass mirror or a plate glass windshield of best material. Lay the plate down against the top of the work bench, which bench top should be squared up until fairly level at first.



Device for straightening shafts, pipe, etc.



Making springs for brake shoes, catches, starting cranks, etc.

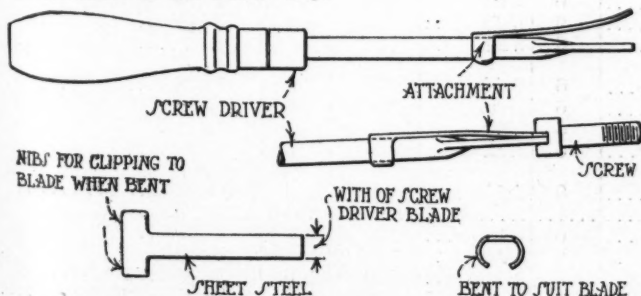
Bent Rod Spring Winder

A mechanic in a local repair shop uses the following method, as illustrated in the sketch above, for making suitable springs for brake shoes, catches, starting cranks, etc., in automobile repair work. As is shown, the spring winder is simply a steel rod about 3/8 in. in diameter, bent to a spiral at one end.

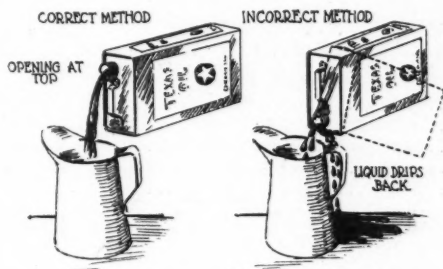
A straight piece of rod with a hole drilled through to insert the end of the spring wire, is the mandrel about which the spring is wound. This tool can be used for winding springs in either the vise or on the lathe, but of course, the spring can be wound more rapidly on the lathe.

Attachment for the Screw-driver

The sketch shows a simple attachment to a screwdriver that the automobile mechanic will appreciate. This enables the mechanic to start screws in inaccessible places, without dismantling sufficient parts to get his hand near the screw hole. Take a piece of sheet steel, cut one end to the width of the screwdriver blade, make two nibs on the opposite end to snap over the blade. The piece is bent to spring outward. The screw is held by the tension of this spring in the slotted screw head. After setting the screw, the attachment is pulled back or removed and the screw is tightened in the usual way.



Attachment for screwdriver which will enable the mechanic to start screws in inaccessible places



Correct method for pouring liquids from a square can

Pouring Liquids From Square Can

A simple suggestion to follow when pouring liquids from a square can, is to pour with the spout at the upper side of the can and avoid the messy dripping of the oil or liquid which accompanies pouring with the spout down.

This permits the air to enter allowing the liquid to flow in a free stream. The gurgling which causes the liquid to gush intermittently and streak down the side of the can, is avoided.

Specifications of the Electrical Equipment Found on 1920 Passenger Cars

Make and Model	IGNITION			GENERATOR		MOTOR		BATTERY			Wiring System	Units Combined	FUSES	
	System	Make	Control	Make	Voltage	Make	Voltage	Make	Amp. Hr.	Voltage			Type	Volts
Allen.....43	Single	Conn.	Hand.	A-L.	6	A-L.	6	Prest-O-L.	80	6	1	GI.	GT.	6
American.....B	Single	Conn.	Hand.	West.	6	Remy.	6	Willard.	90	6	1	S.	3-A.	1.250
Anderson.....All	Single	Remy.	Hand.	Remy.	6	West.	6	Willard.	90	6	1	S.	SAE.	6
Apperson.....All	Single	Remy.	Hand.	Bijur.	6	Bijur.	6-8	Willard.	108	6	1	S.	Open.	1.250
Argonne.....4	Single	Eisemann.	Hand.	West.	12	West.	12	Exide.	100	12	1	S.		12
Auburn.....6-39	Single	Remy.	Hand.	Remy.	6	Remy.	6	Willard.	80	6	1	S.		6-8
Beggs.....20-T	Conn.	Hand.	A-L.	6	A-L.	6	Exide.	80	6	6	1	GT.	Cart.	6
Biddle.....B-1 & B-5	Single	Simms.	Hand.	G & D.	6	G & D.	6	Willard.	90	6	1	S.	GT.	6
Bour-Davis.....20	Single	Remy.	Hand.	Remy.	6	Remy.	6	Willard.	103	6	1	S.	GT.	6
Brewster.....Single	Berling.	Hand.	U. S. L.	12	U. S. L.	12					1			
Briscoe.....4-34	Single	Conn.	Hand.	A-L.	6	A-L.	6	Prest-O-L.	80	6	1	GI.	GT.	6
Buick.....Single	Delco.	Hand.	Delco.	6	Delco.	6	Willard.	80	6	6	1	S.		
Cadillac.....57	Single	Delco.	H. & A.	Delco.	6	Delco.	6	Exide.	130	6	1	GM.		
Case.....V-20	Single	West.	H. & A.	West.	6	West.	6	Willard.	117½	6	1	GI.	5AGT.	50
Chalmers.....35-C	Single	Hand.			6		6		106	6	1	GI.	GT.	6
Champion.....KO	Single	Delco.	Hand.	Dyneto.	6	Dyneto.	6	Willard.	90	6	1	S.	GT.	6
Chandler.....All	Single	Bosch.	Hand.	G & D.	6	G & D.	6	Prest-O-L.	105	6	1	S.	GT.	6
Chevrolet.....All	Single	Remy.	Hand.	A-L.	6	A-L.	6	Willard.	80	6	1	GI.	GT.	6
Cleveland.....40	Single	G & D.	Hand.	G & D.	6	G & D.	6	Prest-O-L.	94	6	1	S.	GT.	6
Cole.....All	Single	Delco.	H & A.	Delco.	6	Delco.	6	Prest-O-L.	50	6	1	S.		
Columbia.....All	Single	At-Kent.	Hand.	A-L.	6	A-L.	6	Prest-O-L.	80	6	1	S.		
Comet.....C-53	Single	Wagner.	Hand.	Wagner.	6	Wagner.	6	Willard.	75	6	1			
Commonwealth.....4-40	Single	At-Kent.	Hand.	Dyneto.	6	Dyneto.	6	Prest-O-L.	105	6	1			
Crow-Elkhart.....L-55	Single	Conn.	Hand.	Dyneto.	6	Dyneto.	6	Exide.	120	6	1		Cart.	6
Cunningham.....V-3	Single	Delco.	H & A.	West.	6	West.	6	Willard.	120	6	1			
Daniels.....8-D	Single	Delco.	H & A.	Delco.	6	Delco.	6	Willard.	140	6	1	S.		
Davis.....51	Single	Delco.	Hand.	Delco.	6	Delco.	6	Willard.	80	6	1	S.		
Dixie Flyer.....Single	Conn.	Hand.	Dyneto.	6	Dyneto.	6	Willard.	6-80			2			
Dodge Brothers.....Single	Own.	H & A.	N. E.	12	North East	12	Willard.	50	12	1	GM.	Encl.	1-50	
Dorris.....6-80	Single	Bosch.	Hand.	West.	6	West.	6	Willard.	115	6	1	S.	GT.	5-8
Dort.....15	Single	Conn.	Hand.	West.	6	West.	6	U. S. L.	85	6	1	S.		6
du Pont.....A	Single	Eisemann.	H & A.	West.	6	West.	6	Exide.	115	6	1	S.		
Economy.....6-46	Single	Own.	Hand.	A-L.	6	A-L.	6	Willard.	90	6				
Elcar.....All	Single	Delco.	Hand.	Delco.	6	Delco.	6	Willard.	90	6	1	S.	GT.	6-8
Elgin.....K	Single	Wagner.	Hand.	Wagner.	6	Wagner.	6	Willard.	90	6	1	S.	GT.	6-8
Essex.....A	Single	Delco.	H & A.	Delco.	7	Delco.	6	Exide.	105	6	1	S.		
Ferris.....Single				L-N.		L-N.								
Ford.....T-4	Single	Own.	Hand.	Own.	6	Own.		Opt.	80	6	1	S.		
Franklin.....9-B	Single	At-Kent.	Auto.	Dyneto.	12	Dyneto.		Willard.	60	12	2	GM.	GT.	14
Gardner.....O	Single	West.	Hand.	West.	6	West.	6	Willard.	90	6	1	S.	GT.	6
Geronimo.....Single	Delco.	Hand.	Dyneto.	6	Dyneto.	6	Willard.	88	6	1	S.			
Grant.....H	Single	At-Kent.	Hand.	Bijur.	6	Bijur.	6	Prest-O-L.	105	6	1	S.	2GT.	6-8
Hanson.....45-A	Single	Remy.	Hand.	A-L.	6	A-L.	6	Prest-O-L.	80	6	1		Cart.	6
Harroun.....Single	Remy.	Hand.	Remy.	6	Remy.	6	Prest-O-L.	80	6	6	1			
Harvard.....4-20	Single	At-Kent.	Hand.	Wagner.	6	Wagner.	6	Nat. Carb.			1	S.		
Hatfield.....A	Single	Conn.	Hand.	Dyneto.	6	Dyneto.	6	Willard.	100	6	1	GI.		
Haynes.....All	Single	Opt.	Hand.	Leece-N.	6	Leece-N.	6	Willard.	120	6	2	GI.	GT.	6
H. C. S. Special.....Single	Delco.	Hand.	Delco.			Delco.								
Hollier.....206-B	Single	R & B.	Hand.	West.	12	West.	6	U. S. L.	80	6	1	S.	GT.	6
Holmes.....Single	Eisemann.	Auto.	Dyneto.	12				Willard.	100	12	2	S.	GT.	15
Hudson Super-Six.....Single	Delco.	H & A.	Delco.	7	Delco.	7	Exide.	105	6	1	GM.			
Huffman.....Single	Conn.	Hand.	Dyneto.	6	Dyneto.	6	Willard.	80	6	1	S.		6	
Hupmobile.....R	Single	At-Kent.	Hand.	West.	6	West.	6	Willard.	90	6	1	S.	Encl.	6
Jackson.....6-38	Single	Remy.	Hand.	A-L.	6	A-L.	6	U. S. L.	94	6	1	GI.	GT.	6-8
Jones.....All	Single	Remy.	Hand.	A-L.	6	A-L.	6	Prest-O-L.	120	6	1	GI.	GT.	6
Jordan.....F	Single	Delco.	Hand.	Delco.	6	Delco.	6	Willard.	108	6	1	S.	C. B.	
Jordan.....M	Single	Delco.	Hand.	Delco.	6	Delco.	6	Willard.	94	6	1	S.	C. B.	
Kenworthy 4-88 & 6-55.....Double	Bosch.	Hand.	West.	6	West.	6	Exide.	140	6	6	1	S.		6
King.....8	Single	At-Kent.	Hand.	West.	6	West.	6	Prest-O-L.	120	6	1	S.	Cart.	6
Kissel.....Single	Remy.	Hand.	Remy.	6	Remy.	6	Willard.	117.5	6	6	1	S.	3 A. G.	6
Kline.....6-55-J	Single	Conn.	Hand.	Wagner.	6	Wagner.	6	Prest-O-L.	80	6	1	S.	5 A. G.	6
LaFayette.....Single	Delco.	H & A.	Delco.	6	Delco.	6	Exide.	130	6			GM.	C. B.	
Leach.....Single	Remy.	Hand.	West.											
Lexington.....8-20	Single	Conn.	Hand.	G & D.	6	G & D.	6	Willard.	100	6	1		GT.	6
Liberty.....10-C	Single	Wagner.	Hand.	Wagner.	6	Wagner.	6	Willard.	90	6	1	GI.		
Locomobile.....48-6-7	Dual	Berling.	Hand.	West.	6	West.	6	Exide.	150	6	1	S.	G. T.	6
Lorraine.....Single	West.	Hand.	West.	6	West.	6	U. S. L.	94	6	6	1	S.	GT.	

ABBREVIATIONS: *Starting and Lighting in closed models only. Ignition: At-K, Atwater-Kent; Conn., Connecticut; West, Westinghouse; Auto, Automatic; H. & A, Hand and Automatic; S. A., Semi-Automatic. Generator: A-L, Auto-Lite; G & D, Gray & Davis; Leece-N, Leece-Neville; Ward-L, Ward-Lewis; N. E., North East; Split, Splitdorf. Motor: A-L, Auto-Lite, G & D, Gray & Davis; Leece-N, Leece-Neville; West, Westinghouse.

Giving Ignition, Starting, Lighting, Battery, Lamp, Spark Plug and Horn Data

LAMP CANDLEPOWER, VOLTAGE AND TYPE OF BASE									SPARK PLUGS			Horn	Make and Model
Base Contact	HEADLIGHTS		SIDELIGHTS		TAILLIGHTS		DASHLIGHT		Make	Diam. Inches	Thread Pitch		
	Volts	CP.	Volts	CP.	Volts	CP.	Volts	CP.					
Single...	6-8	18	*6-8	5	6-8	2	6-8	2	Champion...	7/8	18	Klaxon...	Allen.....43
Single...	6-8	15	*6-8	5	3-4	2	3-4	2	Bethlehem...	7/8	18	Sparton...	American.....B
Single...	6-8	21	6-8	4	6-8	4	6-8	4	A. C.	7/8	18	Klaxon...	Anderson.....All
Double...	6-8	18	*6-8	4	d6-8	2	d6-8	2	A. C.	7/8	18	Sparton...	Apperson.....All
Single...	12	21	12	6	12	2	12	2	A. C.	7/8	18	Klaxon...	Argonne.....4
Single...	6-8	15	*6-8	4	6-8	2	6-8	2	Rajah.....	7/8	18	E. A.	Auburn.....6-39
Single...	6-8	21	6-8	4	3-4	2	3-4	2	Champion...	7/8	18	Trojan...	Beggs.....20-T
Single...	6-8	21	*6-8	4	6-8	2	d6-8	2	Splitdorf...	7/8	18	Klaxon...	Biddle.....B-1 & B-5
Single...	6-8	15	6-8	5	6-8	2	6-8	2	A. C.	7/8	18	E. A.	Bour-Davis.....20
Single...	12	36	12	4	6-8	2	d6-8	2	Herz-Boug...	7/8	18	Klaxon...	Brewster.....
Single...	6-8	21	6-8	4	6-8	2	d6-8	2	Champion...	7/8	18	Sparton...	Briscoe.....4-34
Single...	6-8	15	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Stewart...	Buick.....
Single...	7	18	8	6	4	2	3-4	2	Titan.....	7/8	18	Delco....	Cadillac.....59
Single...	6-8	21	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Case.....V-20
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Chalmers...	35-C
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Garford...	Champion.....KO
Single...	6-8	15	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Chandler.....All
Single...	6-8	21	6-8	4	6-8	2	d6-8	4	A. C.	7/8	18	Klaxon...	Chevrolet.....All
Single...	6-8	17	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Trojan...	Cleveland.....40
Single...	6-8	21	*6-8	5	6-8	4	d6-8	5	A. C.	7/8	18	Sparton...	Cole.....All
Single...	6-8	15	*6-8	4	6-8	2	d6-8	2	Champion...	7/8	18	Schwarze...	Columbia.....All
Single...	6-8	18	6-8	4	6-8	2	6-8	4	Champion...	7/8	18	Klaxon...	Comet.....C-53
Single...	6-8	21	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	E. A. L...	Commonwealth. 4-40
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	E. A. Lab.	Crow-Elkhart. L-55
Single...	6-8	21	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Sparton...	Cunningham....V-3
Single...	6-8	21	6-8	4	6-8	2	d6-8	2	A. C.	7/8	18	Klaxon...	Daniels.....8-D
Single...	6-8	21	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Davis.....51
Double...	6-8	15	6-8	4	d3-4	2	d3-4	2	Champion...	7/8	18	Garford...	Dixie Flyer.....
Single...	12-16	15	6-8	4	12-16	2	12-16	2	A. C.	7/8	18	NorthEast	Dodge Brothers.....
Single...	6-8	21	6-8	4	6-8	2	6-8	2	Opt.....	7/8	18	Klaxon...	Dorris.....
Single...	6-8	15	6-8	4	6-8	2	d6-8	2	A. C.	7/8	18	Schwarze...	Dort.....15
Single...	6-8	21	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	du Pont.....A
Single...	6-8	21	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Economy...	6-46
Single...	6-8	21	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	E. A. L...	Elcar.....All
Single...	6-8	15	6-8	4	3-4	2	*3-4	2	A. C.	18 m.m.	1.5 m.m.	Sparton...	Elgin.....K
Single...	6-8	15	6-8	4	3-4	2	*3-4	2	A. C.	18 m.m.	1.5 m.m.	Sparton...	Essex.....A
Sgl.&Dbl.	6-8	17	6-8	2	6-8	2	6-8	2	Champion...	1/2	pipe	Ferris.....	
Double...	12-16	15	*12-16	4	6-8	2	6-8	2	Opt.....	7/8	18	Own.....	Ford.....T
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Klaxon...	Franklin.....9-B
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Trojan...	Gardner.....G
Single...	6-8	21	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Trojan...	Geronimo.....
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Trojan...	Grant.....H
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Schwarze...	Hanson.....45-A
Single...	6-8	15	6-8	4	3-4	2	d3-4	2	A. C.	7/8	18	Schwarze...	Harroun.....
Single...	6-8	15	3-4	4	3-4	4	*3-4	2	A. C.	7/8	18	Harvard...	4-20
Single...	6-8	15	*4-8	12	6-8	2	6-8	2	A. C.	7/8	18	Ecco.....	Hatfield.....A
Double...	6-8	15	*6-8	12	d6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Haynes.....All
Single...	6-8	15	6	4	3-4	2	3-4	2	A. C.	7/8	18	H. C. S. Special	
Double...	12-16	30	6-8	4	6-8	2	6-8	2	Sparton...	7/8	18	Hollier...	206-B
Single...	6-8	15	6-8	4	3-4	2	*3-4	2	Bethlehem...	7/8	18	Klaxon...	Holmes.....
Single...	6-8	15	6-8	4	3-4	2	*3-4	2	A. C.	7/8	18	Sparton...	Hudson Super Six...
Single...	6-8	15	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Huffman...	
Single...	6-8	15	6-8	4	6-8	2	6-8	2	Trojan...	7/8	18	Hupmobile...	R
Single...	6-8	15	6-8	4	3-4	2	3-4	2	Champion...	7/8	18	Stewart...	Jackson.....6-38
Double...	6-8	15	*6-8	4	s6-8	2	s6-8	2	Champion...	7/8	18	Newtone...	Jones.....
Single...	6-8	18	*6-8	4	6-8	3	6-8	3	A. C.	7/8	18	Sparton...	Jordan.....F
Single...	6-8	18	6-8	4	6-8	3	6-8	3	A. C.	7/8	18	Sparton...	Jordan.....M
Single...	6-8	21	6	4	6-8	2	6-8	2	A. C.	7/8	18	Sparton...	Kenworthy4-88&6-55
Single...	6-8	15	*6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Sparton...	King.....8
Double...	6-8	18	6-8	4	d6-8	2	d6-8	2	A. C.	7/8	18	Sparton...	Kissel.....
Single...	6-8	15	6-8	4	6-8	2	d6-8	2	Champion...	7/8	18	Klaxon...	Kline.....6-55-J
Single...	6-8	21	6-8	6	3-4	2	3-4	2	Champion...	7/8	18	Klaxon...	LaFayette.....
Single...	6-8	21	6-8	4	6-8	2	d6-8	4	Bethlehem...	7/8	18	Leach.....	
Single...	6-8	15	*6-8	4	6-8	2	d6-8	2	A. C.	7/8	18	E. A. L...	Lexington.....S-20
Single...	6-8	21	6-8	4	6-8	2	6-8	2	Titan.....	7/8	18	United...	Liberty.....10-C
Single...	6-8	17	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Locomobile.....48-6-7
Single...	6-8	17	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Schwarze...	Lorraine.....

Battery: Prest-O-Lite, Prest-O-Lite. Wiring system: GI, Generator and Ignition combined; GIM, Generator, Ignition, Motor combined; S, Generator, Motor Ignition separate; GM, Generator and Motor combined. Fuses: GT, Glass Tube; Cart, Cartridge; C. B., Circuit Breaker. Lamps: *Dashlights in series with taillights; headlight contains sidelight; d, double contact; s, single contact.

Specifications of the Electrical Equipment Found on 1920 Passenger Cars

Make and Model	IGNITION			GENERATOR		MOTOR	BATTERY				Wiring System	Units Combined	FUSES		
	System	Make	Control	Make	Voltage		Voltage	Make	Amp. Hr.	Voltage			Type	Volts	Amp.
Maibohm.....B	Single	At-Kent...	Hand...	Bijur.....	6	Bijur.....	6	Willard....	94	6	1	S.....	2-A.....	6	20
Marmion.....34	Single	Delco.....	Auto.....	Delco.....	6	Delco.....	6	Willard....	162	6	1	GI.....			
Maxwell.....25	Single	At-Kent...	Hand...		6		6	Prest-O-L..	87½	6	1	S.....	3A.....	6	20
McFarlan....127	Double	Opt.....	Hand...	West.....	6	West.....	6	Willard....		6	1	GI.....	5 A. G..	6	
Mercer.....Ser. 5	Single	Eisemann..	Hand...	West.....	6	West.....	6	Willard....	182	6	1	S.....	Cart.....		10
Meteor.....KR	Single	Simms.....	Hand...	Bijur.....	6	Bijur.....	6	Willard....		6					
Metz, Master Six..	Single	Conn.....	Hand...	West.....	6	West.....	6	Willard....	120	6	1				
Mitchell.....F-40	Single	Remy.....	Hand...	Remy.....	6	Remy.....	6	Willard....	90	6	1	GI.....	GT.....	6	10
Monitor.....	Single	Conn.....	Hand...	Dyneto....	6	Dyneto....		Prest-O-L..	110	6	1				
Monroe.....S-9	Single	Conn.....	Hand...	A-L.....	6	A-L.....	6	U. S. L....	80	6	1				
Moon.....6-48	Single	Delco.....	Auto.....	Delco.....	6	Delco.....	6	Exide.....	120	6	1	S.....			
Moon.....6-68	Single	Delco.....	Auto.....	Delco.....	6	Delco.....	6	Exide.....	120	6	1	S.....			
Moore.....F	Single	Conn.....	Hand...	A-L.....	6	A-L.....	6	Willard....	80	6	2				
Nash.....	Single	Wagner....	H & A...	Delco.....	6	Wagner....	6	Willard....	100	6	1	S.....			
National.....Series BB	Single	Delco.....	H & A...	West.....	6	West.....	6	Prest-O-L..	110	6	1	S.....	GT.....	6-8	5
Nelson.....D	Single	Bosch.....	Hand...	U. S. L....	12	U. S. L....	12	Willard....	72	12	2	S.....	G.....	12	5-30
Noma.....1-B	Single	Delco.....	Hand...	Delco.....	6	Delco.....	6	Willard....	104	6					
Oakland.....34-B	Single	Remy.....	Hand...	Remy.....	6-8	Remy.....	6	Prest-O-L..	100	6-8	1	GI.....			
Ogren.....6-60	Single	Bosch.....	Hand...	West.....	6	West.....	6	Willard....	120	6	1		Cart.....	6	10
Oldsmobile....37-A	Single	Remy.....	Hand...	Remy.....	6	Willard....	6	Remy.....	80	6	1				
Oldsmobile....45-B	Single	Delco.....	Hand...	Delco.....	6	Delco.....	6	Willard....	80	6	1				
Olympian.....45	Single	Conn.....	Hand...	A-L.....	6	A-L.....	6	U. S. L....		6					
Overland.....4	Single	Conn.....	Hand...	A-L.....	6-8	A-L.....	6	U. S. L....	80	6-8	1	GI.....	Glass....	6	20
Packard.....	Single	Delco.....	H & A...	Bijur.....	6	Bijur.....	6	Willard....	120	6	1	S.....	GT.....	6	10
Paige.....All	Single	At-Kent...	H & A...	G & D....	6	G & D....	6	Willard....	108.4	6	1	S.....	G.....		20
Pan-American..All	Single	At-Kent...	Hand...	West.....	6	West.....	6	Willard....	100	6	1	S.....	G.....	6	
Paterson.....6-47	Dual	Delco.....	Hand...	Delco.....	6	Delco.....	6	Willard....	110	6	1				
Peerless.....Ser. 6	Single	At-Kent...	H & A...	A-L.....	6	A-L.....	6	Willard....		6	1				30
Piedmont.....4-30	Single	Delco.....	Hand...	Dyneto....	6	Dyneto....	6	Willard....	90	6	1	S.....			
Piedmont.....6-40	Single	Remy.....	Hand...	Remy.....	6	Remy.....	6	Willard....	90	6	1	S.....			
Pierce-Arrow..38&48	Double	Delco.....	H & A...	West.....	6-8	West.....	6	Willard....	150	6	1	S.....	5 A. G..	6-8	
Pilot.....6-45	Dual	Delco.....	Hand...	Delco.....	6	Delco.....	6	Prest-O-L..	80	6	1	GI.....			
Porter.....46	Dual	Berling....	Hand...	West.....	12	West.....	12	Prest-O-L..	118	12	1	S.....	Cart.....	12	15
Premier.....6-D	Single	Delco.....	Hand...	Delco.....	6	Delco.....	6	Willard....	123.5	6	1	S.....			
Reo.....T & U	Single	North East	Hand...	North East	6	North East	6	Willard....	108.5	6	2	GI.....	Wire....	6	5
Leo.....T 6& U6	Single	North East	Hand...	North East	6	North East	6	Willard....	108.5	6	1	S.....	Wire....	6	6
Revere.....	Single	Bosch.....	Hand...	West.....	6	West.....	6	Willard....	120	6	1	S.....	GT.....	6	15
Roamer.....4-75	Single	Bosch.....	Hand...	West.....	6	West.....	6	Columbia..	117	6	1	S.....	3A.....	6	15
Roamer.....6-54	Single	Bosch.....	Hand...	Bijur.....	6	Bijur.....	6	Columbia..	117	6	1	S.....	3A.....	6	10
R & V Knight...J & R	Dual	Wagner....	Hand...	Wagner....	6	Wagner....	6	Willard....	117	6	1	S.....	Cart.....	250	20
Saxon.....125	Single	Remy.....	Hand...	Wagner....	6	Wagner....	6	Prest-O-L..	80	6	1	S.....	Cart.....	6-8	15
Sayers.....C.P.	Single	Delco.....	Hand...	Delco.....	6	Delco.....	6	Willard....	80	6	1	GI.....	C.B.....		
Scripps-Booth..B	Single	Remy.....	Hand...	Remy.....	6	Remy.....	6	Prest-O-L..	85	6	1	GI.....	GT.....	6	20
Seneca.....L	Single	Conn.....	Hand...	Allis Chalm	6	Allis Chalm	6	Prest-O-L..	88	6	1	GM.....			20
Severin.....H	Single	Wagner....	Hand...	Wagner....	6	Wagner....	6	Campbell..	110	6	1	None...	Cart.....	6	10
Singer.....20	Single	Bosch.....	Hand...	West.....	6	West.....	6	Willard....	115	6	1	S.....	G. C....		5&10
Skelton.....35	Single	Conn.....	Hand...	West.....	6	West.....	6	Prest-O-L..	85	6	1	S.....		6	10
Spacke.....S-20															
Standard.....8-I	Double	Dixie.....	Hand...	West.....	6	West.....	6	Willard....	160	6	1	S.W....	2-A.....	6	15
Stanley.....735				Remy.....	6			Willard....	100	6	1	G.....	Cart.....	6	20
Stearns.....SKL-4	Single	At-Kent...	Hand...	West.....	12	West.....	12	Willard....	61.5	12	1	S.....			20
Stephens.....80	Single	Conn.....	Hand...	A-L.....	6	A-L.....	6	U. S. L....	116	6	1	S.....	Cart.....	6	20
Stevens-Duryea..E	Double	Berling....	Hand...	West.....	6-8	West.....	6-8			6-8	1	S.....	Cart.....	6	15
Studebaker.....All	Single	Wagner....	Hand...	Wagner....	6	Wagner....	6	Willard....	115	6-8	1	S.....	Cart.....	6	10
Stutz.....H	Double		Hand...	Remy.....	6	Remy.....	6	Willard....		12	1				
Templar.....445	Single	Simms.....	Hand...	Bijur.....	6	Bijur.....	6	Columbia..	100	6	1	S.....		6	20
Texan.....B-38&A-38	Single	Conn.....	Hand...	Bijur.....	6	Bijur.....	6	Prest-O-L..	80	6	1	S.....	Cart.....	6	20
Tulsa.....E-1,2,3	Single	Delco.....	Hand...	Dyneto....	6	Dyneto....	6	Exide.....	90	6	1	S.....	GT.....	6	15
Velie.....48	Single	At-Kent...	S. A....	Bijur.....	6	Bijur.....	6	Willard....	120	6	1	S.....	Wire....		15
Wasp.....	Single	Bosch.....	Hand...	West.....	6	West.....	6	Exide.....	135	6	1	S.....	Cart.....	6	20
Westcott.....C-38&C-48	Single	Delco.....	H & A...	Delco.....	6	Delco.....	6	Willard....	120	6	1	S.....	CB.....		
Willys-Knight..20	Single	Conn.....	Hand...	A-L.....	6-8	A-L.....	6	U. S. L....	170	6	1	GI.....	GT.....	6	20
Winton Six.....24	Single	Bosch.....	Hand...	Bijur.....	6	Bijur.....	6	Willard....	120	6		S.....	GT.....	6	15
Winton Six.....25	Single	Bosch.....	Hand...	Bijur.....	6	Bijur.....	6	Willard....	139	6	1	S.....	CB.....		
Winther.....61	Single	West.....	Hand...	West.....	6	West.....	6	Willard....	127	6		S.....	GI.....	6	10
Wolverine.....	Single	Bosch.....	Hand...	Bijur.....		Bijur.....	6	Prest-O-L..	120	6	1	S.....	CB.....	6	15

ABBREVIATIONS: *Starting and Lighting in closed models only. Ignition: At-K, Atwater-Kent; Conn., Connecticut; West, Westinghouse; Auto, Automatic; H. & A, Hand and Automatic; S. A., Semi-Automatic. Generator: A-L, Auto-Lite; G & D, Gray & Davis; Leece-N, Leece-Neville; Ward-L, Ward-Leonard; N. E., North East; Split, Splitdorf. Motor: A-L, Auto-Lite, G & D, Gray & Davis; Leece-N, Leece-Neville; West, Westinghouse.

Giving Ignition, Starting, Lighting, Battery, Lamp, Spark Plug and Horn Data

LAMP CANDLEPOWER, VOLTAGE AND TYPE OF BASE										SPARK PLUGS			Horn	Make and Model
Base Contact	HEADLIGHTS		SIDELIGHTS		TAILLIGHTS		DASHLIGHT		Make	Diam. Inches	Thread Pitch			
	Volts	CP.	Volts	CP.	Volts	CP.	Volts	CP.						
20	Single...	6-8	20	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Schwarze	Maibohm.....B
	Single...	6-8	27	*6-8	8	6-8	2	6-8	2	A. C.	7/8	18	Sparton...	Marmon.....34
	Single...	6-8	15			6-8	2	6-8	2	Champion...	7/8	18	Schwarze	Maxwell.....25
20	Single...	6-8	21	*6-8	12	6-8	2	d6-8	2	A. C.	7/8	18	Klaxon...	McFarlan.....127
	Single...	6-8	20	6-8	5	6-8	2	6-8	4	Champion...	7/8	18	Sparton...	Mercer.....Ser. 5
	Single...	6-8		6-8		6-8		6-8					Meteor.....	K R
10	Single...	6-8	16	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Trojan...	Metz, Master Six...
	Single...		15			6	2	d6	2	A. C.	7/8	18	Sparton...	Mitchell.....F-40
	Double...	6-8	16			6-8	2	6-8	2	Champion...	7/8	18	Klaxon...	Monitor.....
10	Single...	6-8	20	6-8		6-8	2	d6-8	2	Champion...	7/8	18	Trojan...	Monroe.....S-9
	Single...	6-8	20			6-8	2	d6-8	2	Champion...	7/8	18	Klaxon...	Moon.....6-48
	Single...	6	20	6-8		6-8	2			Champion...	7/8	18	Klaxon...	Moon.....6-68
5	Single...												Garford...	Moore.....F
	Single...	6-8	15	*6-8	4	6-8	2	d6-8	2	A. C.	7/8	18	Trojan...	Nash.....
	Double...	6-8	20	*6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Sparton...	National...Series BB
5-30	Single...	12-16	15	12-16	4	12-16	2	12-16	2	Champion...	7/8	18	Schwarze	Nelson.....D
	Single...	6-8				6-8		d6-8					Noma.....	1-B
	Single...													
10	Single...	6-8	15			6-8	2	6-8	2	A. C.	7/8	18	Schwarze	Oakland.....34-B
	Single...	6	32	6		6	4	6	4	Champion...	7/8	18	Klaxon...	Ogren.....6-60
	Single...	6-8	15	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Oldsmobile.....37-A
20	Single...	6-8	15	*6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Oldsmobile.....45-B
	Single...									Champion...			E. A. Lab.	Olympian.....45
	Single...	6-8	16			3-4	2	*3-4	2	Champion...	1/2		A. L.	Overland.....4
10	Single...	6-8	21	*6-8	4	6-8	2	6-8	4	A. C.	7/8	18	Sparton...	Packard.....
	Single...	6-8	17	6-8	4	6-8	2	d6-8	2	A. C.	7/8	18	Trojan...	Paige.....All
	Single...	6-8	32			6-8	2	*3-4	4	Champion...	7/8	18	E. A. Lab.	Pan-American...All
30	Single...	6-8	15	6-8	4	6-8	2	6-8	2	A. C.			E. A. Lab.	Paterson.....6-47
	Single...	6-8	15	6-8		6-8	2	6-8	4	A. C.			Sparton...	Peerless.....Ser. 6
	Single...	6-8	12			6	2	6	2	Champion...	7/8	18	Klaxon...	Piedmont.....4-30
15	Single...	6-8	12			6	2	6	2	Champion...	7/8	18	Klaxon...	Piedmont.....6-40
	Single...	6-8	20			6-8	5	6-8	5	A. C.	7/8	18	Klaxon...	Pierce-Arrow...38&48
	Single...	6-8	15			6-8	2	6-8	2	A. C.	7/8	18	Schwarze...	Pilot.....6-45
15	Single...	12-16	20	12-16	4	12-16	4	12-16	2	Champion...			Stewart...	Porter.....46
	Double...	6-8	21	*6-8	4	6-8	2	d6-8	2	A. C.	7/8	18	Klaxon...	Premier.....6
	Double...	6-8	15			3-4	2	*3-4	2	A. C.	7/8	18	Trojan...	Reo.....T & U
15	Single...	6-8	15			6	2	*3-4	2	A. C.	1/2		Klaxon...	Reo.....T6 & U6
	Single...	6-8	20	*6-8	8	6-8	4	6-8	4	Rajah.....	7/8	18	Klaxon...	Revere.....
	Single...													
15	Single...	6-8	15	*6-8	2	6-8	2	d6-8	2	A. C.	7/8	18	Roamer...	Roamer.....4-75
	Single...	6-8	15	6-8	4	6-8	2	d6-8	4	A. C.	7/8	18	Sparton...	Roamer.....6-54
	Single...												Klaxon...	R & V Knight. J. & R.
15	Single...	6-8	15			6-8	2	6-8	2	A. C.	7/8	18	Trojan...	Saxon.....125
	Single...	6-8	15			6-8	2	d6-8	2	Champion...	7/8	18	Stewart...	Sayers.....C. P.
	Single...	6-8	18			6-8	2	6-8	2	A. C.	7/8	18	Opt.....	Scripps-Booth...B
20	Single...	6-8	15	6-8	2	6-8	2	d6-8	2	A. C.	7/8	18	Fitzgerald.	Seneca.....L
	Double...	6	17	6	5	6	2	6	2	Champion...	7/8	18	Klaxon...	Severin.....H
	Single...	6-8	15		4	6-8	2	d6-8	2	A. C.	7/8	18	Klaxon...	Singer.....20
5&10	Single...	6	18			6	2	6	2	Bethlehem...	7/8	18	E. A. Lab.	Skelton.....35
	Double...													
	Double...	6-8	21	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Spacke.....S-20
20	Double...	6-8	21	6-8	4	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Standard.....8-I
	Single...	12-16	21	*12-16	4	12-16	2	12-16	2	A. C.	7/8	18	Klaxon...	Stanley.....735
	Single...	6-8	15	6-8	2	6-8	2	6-8	2	A. C.	7/8	18	B. & A. Lab.	Stearns.....SKL-4
20	Single...	6-8	21	6-8	4	6-8	2	6-8	2	Champion...	7/8	18	Trojan...	Stephens.....80
	Single...	6-8	12			6-8	2	6-8	2	Opt.....	7/8	18	Klaxon...	Stevens-Duryea...E
	Double...	6-8	15	*6-8	4	6-8	2	6-8	2	Champion...	1/2		Sparton...	Studebaker.....All
20	Single...												Klaxon...	Stutz.....H
	Single...	6-8	21	*6-8	4	6-8	2	6-8	2	Champion...	7/8		Klaxon...	Templar.....445
	Single...	6	16			6	5	6	5	Champion...	7/8	18	Klaxon...	Texas.....B38&A38
15	Single...	6-8	21	6-8	2	6-8	2	d6-8	2	Champion...	7/8	18	Trojan...	Tulsa.....E-1,2,3
	Single...													
	Single...	6-8	15	6-8	4	6-8	4	d6-8	4	Champion...	7/8	18	Sparton...	Velie.....48
20	Single...													
	Single...	6-8	18	*6-8	4	3-4	2	d3-4	2	A. C.	7/8	18	Klaxon...	Wasp.....
	Single...	6-8	30			3-4	2	*3-4	2	Champion...			Klaxon...	Westcott...C-38&C-48
15	Single...	6-8	21	6-8	6	6-8	2	6-8	2	Champion...	7/8	18	Sparton...	Willys-Knight...20
	Single...	6-8	21	6-8	6	6-8	2	6-8	2	Champion...	7/8	18	American...	Winton Six.....24
	Single...									Champion...	7/8	18	Electric...	Winton Six.....25
10	Single...	6	18			6	4	6	2	A. C.	7/8	18	Klaxon...	Winther.....61
	Single...	6-8	32	6-8	7	6-8	2	6-8	2	A. C.	7/8	18	Klaxon...	Wolverine.....

Battery: Prest-O-Lite, Prest-O-Lite. Wiring system: GI, Generator and Ignition combined; GIM, Generator, Ignition, Motor combined; S, Generator, Motor Ignition separate; GM, Generator and Motor combined. Fuses: GT, Glass Tube; Cart, Cartridge; C. B., Circuit Breaker. Lamps: *Dashlights in series with taillights; headlight contains sidelight; d,—double contact; s,—single contact.

From the Four Winds

Glimpses at the World of Motordom

Coming Motor Events

AUTOMOBILE SHOWS

Brooklyn N. Y.	Automotive Products Show	April 10 to 17
Fort Worth, Tex.	Automobile Show	April 12 to 17
Kingston, Ont.	First Annual Show	April 27 to May 1
Macon, Ga.	Macon Automobile Dealers' Ass'n	May 6 to 8

RACES

Indianapolis Speedway	500-Mile Race	May 31
Uniontown, Pa.	Speedway Race	June 12
Tacoma, Wash.	Speedway Race	July 5
Cincinnati, O.	Speedway Race	Sept. 6
Uniontown, Pa.	Speedway Race	Sept. 6

TOURS

Omaha Neb.	Truck Reliability Run	June 1
Lake Huron Tour		July 4
New York-San Francisco	Glidden Tour	September

Protecting the Public Utilities—The State Public Service Commission, in an opinion refusing to permit John M. Drew, operator of a jitney service from Darby to the Sixty-ninth Street Terminal of the Philadelphia Rapid Transit Co., to increase fares, makes declaration of its intention toward such cases. While the commission will not attempt to regulate small bus or other vehicular concerns, the decision says, under the same standards of valuation and rates of return that apply to heavily capitalized utilities, "elements such as the employment of individual time and talents in the development of such business and which deserve reward entirely apart from any measure of fixed return upon meager amounts of capital invested, must be considered if these small and worthy enterprises are to be encouraged in giving the best possible public service." The commission says that the fact that such utilities are given rights free of charge also must be considered. Drew has an exclusive route and the commission states that the franchise enjoyed should warrant the best class of service at rates entirely reasonable to the riding public. The audit shows that the owner made as high as 74 per cent on the capital actually invested, after the absorption of a very liberal amount of the gross revenues in salaries.

Revise Traffic Regulations—North and south drivers no longer have the right of way at street intersections in Fort Wayne, Ind., according to a new traffic ordinance recently adopted by the city council. The new ordinance declares that every driver approaching an intersection of a street shall give the right-of-way to any vehicle approaching from his right.

A new rule of the ordinance forbids any vehicle making a complete turn in any street within a section defined as the congested district except at a street intersection.

Among other features particularly applying to automobiles are the following: Automobiles and trucks having a wheelbase longer than 138 in. may go to the left of a Keep to the Right traffic sign in making a turn to the left after first coming to a full stop.

No one under sixteen years of age can drive any motor vehicle or motor bicycle. A new provision makes it unlawful for the owner of a car to permit any person under age to drive it. Exhaust whistles and siren whistles or other unusually loud whistles or signals are prohibited.

Iowa Registration Figures—Iowa registered 356,685 motor cars between Jan. 1 and March 31, according to announcements made this week by the secretary of state. Collections of motor license fees total \$5,067,367 to date. W. C. Ransley, secretary of state, estimates that the total registration in Iowa this year will run to at least 425,000, and that at least another million dollars in fees will be paid. Ninety-four per cent of the money derived from fees goes into the state highway fund.

Seeing Is Believing



They promise us actual speed in delivering messages nowadays. At least a telegraph company has decided to equip its messengers with Henry's in order to get them hither and thence in less time. But we fear that the vast majority of messenger boys will continue to indulge in the dread disease of movie-itis or become plethoric promoters of African golf games. And we don't believe otherwise until we see some speed becoming manifest